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December 1992

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AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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BIBLIOGRAPHY WITH INDEXES
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NASA SP-7011 (369)

December 1992

AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES



National Aeronautics and Space Administration
Scientific and Technical Information Program
Washington, DC

1992

INTRODUCTION

This issue of *Aerospace Medicine and Biology* (NASA SP-7011) lists 209 reports, articles and other documents originally announced in November 1992 in *Scientific and Technical Aerospace Reports (STAR)* or in *International Aerospace Abstracts (IAA)*. The first issue of *Aerospace Medicine and Biology* was published in July 1964.

Accession numbers cited in this issue are:

STAR (N-10000 Series)	N92-30233 — N92-32242
IAA (A-10000 Series)	A92-49230 — A92-53429

In its subject coverage, *Aerospace Medicine and Biology* concentrates on the biological, physiological, psychological, and environmental effects to which humans are subjected during and following simulated or actual flight in the Earth's atmosphere or in interplanetary space. References describing similar effects on biological organisms of lower order are also included. Such related topics as sanitary problems, pharmacology, toxicology, safety and survival, life support systems, exobiology, and personnel factors receive appropriate attention. Applied research receives the most emphasis, but references to fundamental studies and theoretical principles related to experimental development also qualify for inclusion.

Each entry in the publication consists of a standard bibliographic citation accompanied in most cases by an abstract. The listing of the entries is arranged by *STAR* categories 51 through 55, the Life Sciences division. The citations include the original accession numbers from the respective announcement journals.

Seven indexes—subject, personal author, corporate source, foreign technology, contract, report number, and accession number—are included.

A cumulative index for 1992 will be published in early 1993.

Information on availability of documents listed, addresses of organizations, and CASI price schedules are located at the back of this issue.

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TYPICAL REPORT CITATION AND ABSTRACT

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ACCESSION NUMBER → N92-28671*# Iowa State Univ. of Science and Technology, ← CORPORATE SOURCE
Ames. Dept. of Chemical Engineering.

TITLE → SPACE LIFE SUPPORT ENGINEERING PROGRAM Annual
Progress Report, 1 Jul. 1991 - 30 Jun. 1992

AUTHOR → RICHARD C. SEAGRAVE 30 Jun. 1992 36 p

CONTRACT NUMBER → (Contract NAG2-722) PUBLICATION DATE

REPORT NUMBERS → (NASA-CR-190448; NAS 1.26:190448) Avail: CASI HC A03/MF PRICE CODE
A01 AVAILABILITY SOURCE

A comprehensive study to develop software to simulate the dynamic operation of water reclamation systems in long-term closed-loop life support systems is being carried out as part of an overall program for the design of systems for a moon station or a Mars voyage. This project is being done in parallel with a similar effort in the Department of Chemistry to develop durable accurate low-cost sensors for monitoring of trace chemical and biological species in recycled water supplies. Aspen-Plus software is being used on a group of high-performance work stations to develop the steady state descriptions for a number of existing technologies. Following completion, a dynamic simulation package will be developed for determining the response of such systems to changes in the metabolic needs of the crew and to upsets in system hardware performance.

Author

TYPICAL JOURNAL ARTICLE CITATION AND ABSTRACT

ACCESSION NUMBER → A92-10353

TITLE → EFFECTS OF HYPOXIA AND COLD ACCLIMATION ON
THERMOREGULATION IN THE RAT

AUTHORS → H. GAUTIER, M. BONORA, S. B. M'BAREK, and J. D. SINCLAIR
(Paris VI, Universite, France; Auckland, University, New Zealand) ← AUTHORS' AFFILIATION

JOURNAL TITLE → Journal of Applied Physiology (ISSN 0161-7567), vol. 71, Oct. 1991, ← PUBLICATION DATE
p. 1355-1363. Research supported by Institut National de la Sante
et de la Recherche Medicale. refs

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Results are reported from an experimental study tracing the effects of hypoxia on thermoregulation and on the different sources of thermogenesis in rats before and after periods of 1-4 wk of cold acclimation. Measurements of the metabolic rate (VO_2) and body temperature (T_b) were made at 5-min intervals, and shivering activity was recorded continuously in groups of rats subjected to three protocols. Recordings were made in normoxia and in hypoxia on different days in the same animals. The results show that: (1) in noncold-acclimated (NCA) rats, cold exposure induced increases in VO_2 and shivering that were proportional to the decrease in T_a ; (2) in cold-acclimated (CA) rats in normoxia, for a given ambient temperature, VO_2 and T_b were higher than in NCA rats, whereas shivering was generally lower; and (3) in both NCA and CA rats, hypoxia induced a transient decrease in shivering and a sustained decrease in nonshivering thermogenesis associated with a marked decrease in T_b that was about the same in NCA and CA rats. It is concluded that hypoxia acts on T_b control to produce a general inhibition of thermogenesis.

P.D.

AEROSPACE MEDICINE AND BIOLOGY

A Continuing Bibliography (Suppl. 369)

December 1992

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LIFE SCIENCES (GENERAL)

A92-49507

MEGASCOPIC EUKARYOTIC ALGAE FROM THE 2.1-BILLION-YEAR-OLD NEGAUNEE IRON-FORMATION, MICHIGAN

TSU-MING HAN (Cliffs Mining Services Co., Research Laboratory, Ishpeming, MI) and BRUCE RUNNEGAR (California, University, Los Angeles) *Science* (ISSN 0036-8075), vol. 257, no. 5067, July 10, 1992, p. 232-235. refs
Copyright

Hundreds of specimens of spirally coiled, megascopic, carbonaceous fossils resembling *Grypania spiralis* (Walcott), have been found in the 2.1-billion-year-old Negaunee Iron-Formation at the Empire Mine, near Marquette, Michigan. This occurrence of *Grypania* is 700 million to 1000 million years older than fossils from previously known sites in Montana, China, and India. As *Grypania* appears to have been a photosynthetic alga, this discovery places the origin of organelle-bearing eukaryotic cells prior to 2.1 billion years ago. Author

A92-49621

LIFE-SCIENCE PAYLOAD FOR THE SPACELAB MISSION E-1 WOLFRAM LORK, MARTIN EYB, and EBERHARDT WAFFENSCHMIDT Dornier Post (ISSN 0012-5563), no. 2, 1992, p. 19-21.

Copyright

The European Spacelab mission E-1, which is scheduled for early 1997, is designed to ensure the continuity of Spacelab missions for research purposes and to test typical operating scenarios for a future Space station (precursor to Columbus). As far as the scientific payloads in the space laboratory are concerned, two aspects should be pointed out: automatic facilities operation requiring little intervention on the part of the mission specialists, and scientific and technical control of the facilities from the ground (telescience). Author

A92-50070

REDUCTION IN MYOTENDINOUS JUNCTION SURFACE AREA OF RATS SUBJECTED TO 4-DAY SPACEFLIGHT

JAMES G. TIDBALL and DONNA M. QUAN (California, University, Los Angeles) *Journal of Applied Physiology* (ISSN 8750-7587), vol. 73, no. 1, July 1992, p. 59-64. Research supported by Pennsylvania State University and Genentech. refs
(Contract NIH-AR-40343)
Copyright

The effect, in rats, of a 4-day-long spaceflight on the surface area of myotendinous junctions (MTJs), expressed relative to the cross-sectional area of myofibrils attached to them, was investigated using established morphometric techniques. Results show that the exposure to weightlessness resulted in a significant reduction in relative MTJ surface area (from about 19.7 in ground controls to 13.3 in animals after spaceflight). The space-flown animals also exhibited increased numbers of fibroblasts enriched

in rough endoplasmic reticulum near MTJs, a greater number of ribosomes and mitochondria within muscle MTJs, and an increased occurrence of lesions in the connective tissue near MTJs. I.S.

A92-50073

EFFECTS OF COLD ON VASCULAR PERMEABILITY AND EDEMA FORMATION IN THE ISOLATED CAT LIMB

MATTHEW B. WOLF, LINDA P. PORTER, DUNCAN R. C. SCOTT, II, and JIAN X. ZHANG (South Carolina, University, Columbia) *Journal of Applied Physiology* (ISSN 8750-7587), vol. 73, no. 1, July 1992, p. 166-172. Research supported by U.S. Navy and South Carolina Heart Association. refs
(Contract NIH-HL-39691)
Copyright

A92-50176

TELESCIENCE TESTBED - OPERATIONAL SUPPORT FUNCTIONS FOR BIOMEDICAL EXPERIMENTS

MASAMICHI YAMASHITA (Institute of Space and Astronautical Science, Sagamihara, Japan), SATORU WATANABE (Nagoya University, Japan), TAKATOSHI SHOJI (Kawasaki Heavy Industries, Ltd., Kakamigahara, Japan), ANDREW H. CLARKE (Berlin, Freie Universitaet, HNO Klinik, Federal Republic of Germany), HIROYUKI SUZUKI (Nagoya University, Japan), and DAI YANAGIHARA (Chukyo University, Toyota, Japan) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) *Acta Astronautica* (ISSN 0094-5765), vol. 27, July 1992, p. 155-161. refs
Copyright

A telepresence testbed was conducted to study the methodology of space biomedicine with simulated constraints imposed on space experiments. An experimental subject selected for this testbedding was an elaborate surgery of animals and electrophysiological measurements conducted by an operator onboard. The standing potential in the ampulla of the pigeon's semicircular canal was measured during gravitational and caloric stimulation. A principal investigator, isolated from the operation site, participated in the experiment interactively by telecommunication links. Reliability analysis was applied to the whole layers of experimentation, including design of experimental objectives and operational procedures. Engineering and technological aspects of telepresence are discussed in terms of reliability to assure quality of science. Feasibility of robotics was examined for supportive functions to reduce the workload of the onboard operator. Author

A92-50187* National Aeronautics and Space Administration, Washington, DC.

THERMAL DEGRADATION EVENTS AS HEALTH HAZARDS - PARTICLE VS GAS PHASE EFFECTS, MECHANISTIC STUDIES WITH PARTICLES

G. OBERDOERSTER, J. FERIN, J. FINKELSTEIN, and S. SODERHOLM (Rochester, University, NY) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) *Acta Astronautica* (ISSN 0094-5765), vol. 27, July 1992, p. 251-256. refs
(Contract NAGW-2356; NIH-ES-01247; NIH-ES-04872)
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Experiments on animal subjects are performed to demonstrate

ABSTRACTS

that significant lung injury can result from the inhalation of ultrafine TiO₂ or Al₂O₃ particles. The methods include intratracheal instillation of particles, long-term inhalation of particles, and in vitro studies of alveolar macrophages (AMs) to study the production of fibroblast growth factors. The ultrafine TiO₂ particles are shown to induce more acute inflammatory reactions than larger particles and lead to persistent chronic effects in the AM-mediated clearance function of particles. The ultrafine particles also induce cytokines more readily, and the data generally suggests that the occurrence of such particles in thermal degradation events makes the fumes highly toxic. The exposure to thermal degradation products is therefore a critical concern for manned space missions with potentially degradable plastic products. C.C.S.

A92-50285 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

EXERCISE PERFORMANCE, CORE TEMPERATURE, AND METABOLISM AFTER PROLONGED RESTRICTED ACTIVITY AND RETRAINING IN DOGS

K. NAZAR (Polish Academy of Sciences, Medical Research Center, Warsaw, Poland), J. E. GREENLEAF (NASA, Ames Research Center, Moffett Field, CA), E. POHOSKA, E. TURLEJSKA, H. KACIUBA-USCILKO, and S. KOZLOWSKI (Polish Academy of Sciences, Medical Research Center, Warsaw, Poland) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 63, no. 8, Aug. 1992, p. 684-688. Research supported by Polish Programme for Basic Research and NASA. refs

Copyright

Physiological effects of restricted activity (RA) and subsequent retraining have been studied. Ten male mongrel dogs performed a submaximal exercise endurance test on a treadmill during kennel control, after 8 weeks of cage confinement and after eight weeks of retraining using the same treadmill protocol 1 h/d for 6 d/week. Data obtained show that RA reduces exercise endurance, the effectiveness of exercise thermoregulation, muscle glycogen stores, and the lipolytic response to exercise and to noradrenaline stimulation. O.G.

A92-50288

EMESIS IN FERRETS FOLLOWING EXPOSURE TO DIFFERENT TYPES OF RADIATION - A DOSE-RESPONSE STUDY

BERNARD M. RABIN, WALTER A. HUNT, MATTHEW E. WILSON, and JAMES A. JOSEPH (U.S. Army, Armed Forces Radiobiology Research Institute, Bethesda, MD) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 63, no. 8, Aug. 1992, p. 702-705. Research supported by U.S. Army and DNA. refs

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Ferrets were exposed to gamma rays (Co-60), fission neutrons, high-energy electrons (18.5 MeV) or iron particles (Fe-56, 600 MeV/amu) in order to establish the dose-response relationships for emesis following exposure to different types of radiation. The results showed that the mean effective doses ED(50)s for iron particles (35 cGy) and neutrons (40 cGy) were similar. High-energy electrons were the least effective radiation, with an ED(50) of 138 cGy. Gamma rays, with an ED(50) of 95 cGy, showed an intermediate effectiveness. The results suggest that the relative effectiveness of different types of radiation generally increases with an increase in linear energy transfer (LET), although LET is not completely predictive of relative behavioral effectiveness.

Author

A92-50831* National Aeronautics and Space Administration, Washington, DC.

DIRECTED EVOLUTION OF AN RNA ENZYME

AMBER A. BEAUDRY and GERALD F. JOYCE (Scripps Institution of Oceanography, La Jolla, CA) Science (ISSN 0036-8075), vol. 257, no. 5070, July 31, 1992, p. 635-641. refs (Contract NAGW-1671; NIH-AI-30882)

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An in vitro evolution procedures was used to obtain RNA enzymes with a particular catalytic function. A population of 10

exp 13 variants of the Tetrahymena ribozyme, a group I ribozyme that catalyzes sequence-specific cleavage of RNA via a phosphoester transfer mechanism, was generated. This enzyme has a limited ability to cleave DNA under conditions of high temperature or high MgCl₂ concentration, or both. A selection constraint was imposed on the population of ribozyme variants such that only those individuals that carried out DNA cleavage under physiologic conditions were amplified to produce 'progeny' ribozymes. Mutations were introduced during amplification to maintain heterogeneity in the population. This process was repeated for ten successive generations, resulting in enhanced (100 times) DNA cleavage activity. Author

A92-51471 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

ADAPTATIONS OF YOUNG ADULT RAT CORTICAL BONE TO 14 DAYS OF SPACEFLIGHT

A. C. VAILAS, R. VANDERBY, JR., D. A. MARTINEZ, R. B. ASHMAN, M. J. ULM, R. E. GRINDELAND, G. N. DURNOVA, and A. KAPLANSKII (Wisconsin, University, Madison; NASA, Ames Research Center, Moffett Field, CA; Texas Scottish Rite Hospital, Dallas; Institute of Biomedical Problems, Moscow, Russia) Journal of Applied Physiology, Supplement (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 4S-9S. refs (Contract NAG2-568; NGT-70093)

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To determine whether mature humeral cortical bone would be modified significantly by an acute exposure to weightlessness, adult rats (110 days old) were subjected to 14 days of microgravity on the COSMOS 2044 biosatellite. There were no significant changes in peak force, stiffness, energy to failure, and displacement at failure in the flight rats compared with ground-based controls. Concentrations and contents of hydroxyproline, calcium, and mature stable hydroxylsilypyridinoline and lysylpyridinoline collagen cross-links remained unchanged after spaceflight. Bone lengths, cortical and endosteal areas, and regional thicknesses showed no significant differences between flight animals and ground controls. The findings suggest that responsiveness of cortical bone to microgravity is less pronounced in adult rats than in previous spaceflight experiments in which young growing animals were used. It is hypothesized that 14 days of spaceflight may not be sufficient to impact the biochemical and biomechanical properties of cortical bone in the mature rat skeleton. Author

A92-51472* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

MORPHOLOGICAL STUDIES OF BONE AND TENDON

STEPHEN B. DOTY, EMILY R. MOREY-HOLTON, G. N. DURNOVA, and A. S. KAPLANSKII (Hospital for Special Surgery, New York; NASA, Ames Research Center, Moffett Field, CA; Institute of Biomedical Problems, Moscow, Russia) Journal of Applied Physiology, Supplement (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 10S-12S. refs

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The Soviet biosatellite Cosmos 2044 carried adult rats on a spaceflight that lasted 13.8 days and was intended to repeat animal studies carried out on Cosmos 1887. Skeletal tissue and tendon from animals flown on Cosmos 2044 were studied by light and electron microscopy, histochemistry, and morphometric techniques. Studies were confined to the bone cells and vasculature from the weight-bearing tibias. Results indicated that vascular changes at the periosteal and subperiosteal region of the tibia were not apparent by light microscopy or histochemistry. However, electron microscopy indicated that vascular inclusions were present in bone samples from the flight animals. A unique combination of microscopy and histochemical techniques indicated that the endosteal osteoblasts from this same middiaphyseal region demonstrated a slight (but not statistically significant) reduction in bone cell activity. Electron-microscopic studies of the tendons from metatarsal bones showed a collagen fibril disorganization as a result of spaceflight. Thus changes described for Cosmos 1887 were present in Cosmos 2044, but the changes ascribed to spaceflight were not as evident. Author

A92-51473* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

PREOSTEOBLAST PRODUCTION IN COSMOS 2044 RATS - SHORT-TERM RECOVERY OF OSTEOGENIC POTENTIAL

LAWRENCE P. GARETTO, EMILY R. MOREY, G. N. DURNOVA, A. S. KAPLANSKII, and W. E. ROBERTS (Indiana, University, Indianapolis; NASA, Ames Research Center, Moffett Field, CA; Institute of Biomedical Problems, Moscow, Russia) *Journal of Applied Physiology, Supplement* (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 14S-18S. refs

(Contract NCC2-594; NIH-DE-09237-01)

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The influence of a 13.8-day spaceflight and about 8.5-11 h of recovery at 1 g on fibroblastlike osteoblast precursor cells was assessed in the periodontal ligament of rat maxillary first molars. Preosteoblasts (C + D cells), less differentiated progenitor cells (A + A prime cells), and nonosteogenic fibroblastlike cells (B cells) were identified by nuclear volume analysis. No differences were observed among flight, synchronous vivarium, and basal control groups in the A + A prime or C + D cell compartments. Compared with previous spaceflight experiments, the present data are consistent with a postflight response to replenish preosteoblasts and restore periodontal ligament osteogenic potential. These data emphasize the need to unequivocally determine the flight effect by killing the animals in-flight and further assess the postflight recovery phenomenon. Author

A92-51474* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

SPACEFLIGHT AND AGE AFFECT TIBIAL EPIPHYSEAL GROWTH PLATE HISTOMORPHOMETRY

DINA MONTUFAR-SOLIS, PAULINE J. DUKE, and G. DURNOVA (Texas, University, Health Science Center, Houston; Institute of Biomedical Problems, Moscow, Russia) *Journal of Applied Physiology, Supplement* (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 19S-25S. refs

(Contract NCC2-423)

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Growth plate histomorphometry of rats flown aboard the Soviet biosatellite Cosmos 2044, a 14-day spaceflight, was compared with that of control groups. In growth plates of flight animals, there was a significant increase in cell number per column and height of the proliferative zone and a reduction in height and cell number in the hypertrophy/calcification zone. No significant differences were found in matrix organization at the ultrastructural level of flight animals, indicating that although spaceflight continues to affect bone growth of 15-wk-old rats, extracellular matrix is not altered in the same manner as seen previously in younger animals. All groups showed growth plate characteristics attributed to aging: lack of calcification zone, reduced hypertrophy zone, and unraveling of collagen fibrils. Tail-suspended controls did not differ from other controls in any of the parameters measured. The results suggest that growth plates of older rats are less responsive to unloading by spaceflight or suspension than those of younger rats and provide new evidence about the modifying effect of spaceflight on the growth plate. Author

A92-51475
EFFECTS OF MICROGRAVITY ON THE COMPOSITION OF THE INTERVERTEBRAL DISK

ANGIOLA PEDRINI-MILLE, JERRY A. MAYNARD, G. N. DURNOVA, A. S. KAPLANSKII, VITTORIO A. PEDRINI, CHRISTINE B. CHUNG, and JOAN FEDLER-TROESTER (Iowa, University, Iowa City; Institute of Biomedical Problems, Moscow, Russia) *Journal of Applied Physiology, Supplement* (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 26S-32S. refs

Copyright

The lumbar annuli of rats flown on Cosmos 2044 were compared with those of three control groups and a tail-suspension experimental model. The wet and dry weights of the annuli were significantly smaller (P less than 0.05) in the flight group than in three control groups. The collagen-to-proteoglycan ratio was significantly greater (P less than 0.001) in the flight group than in

the three control groups, but there were no detectable changes in the relative proportions of type I and II collagen or in the number of pyridinoline cross-links. Safranin-O indicated a normal spatial distribution of the proteoglycans within the annulus. Tail suspension did not affect the size of the annuli, but more proteoglycans (Pless than 0.05) leached from the tissue of suspended animals than from the normal annuli. It is, however, probable that these changes may affect the biomechanical functions of the annulus, although they may be temporary and totally reversible if injuries are avoided in the interim period. Author

A92-51476* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

MUSCLE SARCOMERE LESIONS AND THROMBOSIS AFTER SPACEFLIGHT AND SUSPENSION UNLOADING

D. A. RILEY, S. ELLIS, C. S. GIOMETTI, J. F. Y. HOH, E. I. IL'INA-KAKUEVA, V. S. OGANOV, G. R. SLOCUM, J. L. W. BAIN, and F. R. SEDLAK (Wisconsin, Medical College, Milwaukee; San Jose State University, CA; Argonne National Laboratory, IL; Sydney, University, Australia; Institute of Biomedical Problems, Moscow, Russia) *Journal of Applied Physiology, Supplement* (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 33S-43S. refs

(Contract NAG2-460; NAG2-410; W-13-109-ENG-38)

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Data obtained during Cosmos 2044 bisatellite mission are reviewed and found to be consistent with the results of previous rodent spaceflight experiments. Investigation was carried out of hindlimb muscles from flight rats killed as close to land as possible so that changes induced by spaceflight and early readaptation to weight bearing could be distinguished from the changes that resulted from the two-day postflight period during Cosmos 1887. Results presented pertain to muscle atrophy and fiber type changes, eccentric contraction-like lesions, microcirculatory changes and interstitial edema, and tissue damage. O.G.

A92-51477* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

SKELETAL MUSCLE ATROPHY IN RESPONSE TO 14 DAYS OF WEIGHTLESSNESS - VASTUS MEDIALIS

X. J. MUSACCHIA, J. M. STEFFEN, R. D. FELL, M. J. DOMBROWSKI, V. W. OGANOV, and E. I. IL'INA-KAKUEVA (Louisville, University, KY; Institute of Biomedical Problems, Moscow, Russia) *Journal of Applied Physiology, Supplement* (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 44S-50S. Research supported by Southern Regional Education Board. refs

(Contract NAG2-386)

Copyright

The vastus medialis (VM) response from rats after 14 days of microgravity on Cosmos 2044 (F) have been studied by comparing it with VM from tail-suspended hindlimb-unloaded rats (T) and ground controls. The experimental approaches encompassed a histochemical evaluation of microscopic morphology, including fibers and capillaries; an assessment of biochemical composition including protein, DNA, and RNA concentrations; and an estimation of metabolic capacity. It is concluded that some significant changes were observed in the VM in rats exposed to weightlessness for 14 days. There is a loss in weight compared with the vivarium controls but not in comparison with synchronous and basal controls. Although there were minimal muscle weight differences between groups, muscle weight may be a less sensitive measure of change or atrophy than fiber area measurements. It is suggested that the nonload-bearing muscles, including the VM, show measurable responses to weightless flight. O.G.

A92-51478* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

RAT SOLEUS MUSCLE FIBER RESPONSES TO 14 DAYS OF SPACEFLIGHT AND HINDLIMB SUSPENSION

YOSHI OHIRA, BIAN JIANG, ROLAND R. ROY, V. OGANOV, E. I. IL'INA-KAKUEVA, J. F. MARINI, and V. R. EDGERTON (California, University, Los Angeles; Institute of Biomedical Problems, Moscow, Russia; Institut National de la Sante et de la Recherche Medicale, Marseille, France) *Journal of Applied*

Physiology, Supplement (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 51S-57S. refs
(Contract NCC2-535)
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Morphological and enzymatic responses in fibers of different types were studied in rats after 14 days of spaceflight onboard Cosmos 2044 or hindlimb suspension. Fibers were classified as fast-twitch, slow-twitch, or both fast- and slow-twitch on the basis of the type of myosin heavy chains (MHC). Data obtained indicate that during the 14 days of spaceflight or suspension the protein profiles of 9-14 percents of the slow-twitch fibers reconfigured from typical slow-twitch toward fast twitch fibers, while all fibers were dramatically losing total protein. These results were consistent with the data obtained from Cosmos 1887 and Skylab 3. It is suggested that effects of spaceflight on skeletal muscle can be attributed to a dramatic reduction in the level and/or pattern of loading. O.G.

A92-51479* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

ADAPTATION OF FIBERS IN FAST-TWITCH MUSCLES OF RATS TO SPACEFLIGHT AND HINDLIMB SUSPENSION

BIAN JIANG, YOSHI OHIRA, ROLAND R. ROY, QUYET NGUYEN, E. I. IL'INA-KAKUEVA, V. OGANOV, and V. R. EDGERTON (California, University, Los Angeles; Institute of Biomedical Problems, Moscow, Russia) Journal of Applied Physiology, Supplement (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 58S-65S. refs

(Contract NCC2-535)

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The adaptation of single fibers in medial gastrocnemius (MG), a fast-twitch extensor, and in tibialis anterior (TA), a fast-twitch flexor, was studied after 14 days of spaceflight onboard Cosmos 2044 or hindlimb suspension. Quantitative myosin ATPase activities of single fibers were measured in flight and suspended rats. Each of the enzyme and size measurements were directly correlated within each fiber with respect to its qualitative myosin ATPase staining properties and its expression of fast, slow, or both myosin heavy chains (MHC). The percentage of slow- and fast-twitch fibers of the MG and TA were found to be unchanged. Mean fiber size of all fibers was unaffected after flight or suspension. The ATPase activity in the MG was higher in flight than in control or suspended rats. In comparison to Cosmos 1887 spaceflight, the adaptations in the muscle fibers of the MG were more moderate. O.G.

A92-51480* National Aeronautics and Space Administration, Washington, DC.

EFFECTS OF MICROGRAVITY AND TAIL SUSPENSION ON ENZYMES OF INDIVIDUAL SOLEUS AND TIBIALIS ANTERIOR FIBERS

MAGGIE M.-Y. CHI, RATI CHOSKI, PATTI NEMETH, IGOR' KRASNOV, E. I. IL'INA-KAKUEVA, JILL K. MANCHESTER, and OLIVER H. LOWRY (Washington University, Saint Louis, MO; Institute of Biomedical Problems, Moscow, Russia) Journal of Applied Physiology, Supplement (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 66S-73S. Research supported by NASA. refs

(Contract NIH-R01-NS-08862)

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Selected enzymes of energy metabolism were measured in random individual fibers of soleus and tibialis anterior (TA) muscles from rats exposed for 2 wk to spaceflight (F) aboard Cosmos 2044 or tail suspension (T) and from synchronous controls. Average size of soleus fibers (dry weight per unit length) was reduced 37 percent in F and T fibers; there was little change in TA fibers. Enzyme changes were more pronounced in soleus than in TA fibers. Three enzymes characteristic of fast-twitch muscles, pyruvate kinase, glycerol-3-phosphate dehydrogenase, and 1-phosphofructokinase, were elevated in F and T soleus fibers, but changes in phosphofructokinase were not statistically significant. In TA fibers analyzed for hexokinase, malate dehydrogenase, phosphohexoisomerase, and pyruvate kinase, only hexokinase and malate dehydrogenase showed significant changes. Hexokinase increased 83 percent in one of two T muscles.

Enzyme data for TA fibers typed by myosin adenosinetriphosphatase were more informative: phosphofructokinase, phosphorylase, and glycerol-3-phosphate dehydrogenase were increased in type IIa fibers of either F or T muscles or both. Malate dehydrogenase was not changed in fibers of any type in either F or T muscle. Author

A92-51481* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

EFFECT OF SPACEFLIGHT ON THE EXTRACELLULAR MATRIX OF SKELETAL MUSCLE AFTER A CRUSH INJURY

W. T. STAUBER, V. K. FRITZ, T. E. BURKOVSKAIA, and E. I. IL'INA-KAKUEVA (West Virginia, University, Morgantown; Institute of Biomedical Problems, Moscow, Russia) Journal of Applied Physiology, Supplement (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 74S-81S. Research supported by Comptex, Inc. refs

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The organization and composition of the extracellular matrix were studied in the crush-injured gastrocnemius muscle of rats subjected to 0 G. After 14 days of flight on Cosmos 2044, the gastrocnemius muscle was removed and evaluated by histochemical and immunohistochemical techniques from the five injured flight rodents and various earth-based treatment groups. In general, the repair process was similar in all injured muscle samples with regard to the organization of the extracellular matrix and myofibers. Small and large myofibers were present within an expanded extracellular matrix, indicative of myogenesis and muscle regeneration. In the tail-suspended animals, a more complete repair was observed with nonenlarged area of nonmuscle cells or matrix material visible. In contrast, the muscle samples from the flight animals were less well organized and contained more macrophages and blood vessels in the repair region, indicative of a delayed repair process, but did not demonstrate any chronic inflammation. Myofiber repair did vary in muscles from the different groups, being slowest in the flight animals and most complete in the tail-suspended ones. Author

A92-51482* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

SPACEFLIGHT AND GROWTH EFFECTS ON MUSCLE FIBERS IN THE RHESUS MONKEY

SUE C. BODINE-FOWLER, ROLAND R. ROY, WILLIAM RUDOLPH, NAZ HAQUE, INESSA B. KOZLOVSKAIA, and V. R. EDGERTON (California, University, La Jolla and Los Angeles; Institute of Biomedical Problems, Moscow, Russia) Journal of Applied Physiology, Supplement (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 82S-89S. refs

(Contract NCC2-535)

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The effect of a 14-day spaceflight onboard Cosmos 2044 on selected morphological and metabolic properties of single muscle fibers was investigated in a nonhuman primate, Macaca mulatta. It is concluded that the 14-day spaceflight had little impact on fiber size in the soleus (S) and medial gastrocnemius (MG) muscles, whereas it appeared to be a slight decrease in sized in the tibialis anterior (TA). The mean fiber size in the postflight biopsies increased relative to preflight values. The mean fiber succinate dehydrogenase activity was found to decrease in the MG, whereas there was no apparent effect of spaceflight on the S and TA muscles. The differences in response of the S, MG, and TA to spaceflight in monkeys vs rats may be related to a species responsiveness to spaceflight, the manner in which the animals were restrained, and/or the possibility that the ankle musculature was able to function against a load while in space. O.G.

A92-51483

ALTERED ACTIN AND MYOSIN EXPRESSION IN MUSCLE DURING EXPOSURE TO MICROGRAVITY

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Applied Physiology, Supplement (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 90S-93S. refs
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The mechanism for cardiovascular deconditioning and skeletal muscle atrophy during microgravity is not known. The purpose of the present study was to determine whether a decrease in contractile protein gene expression in the muscle of rats occurred after 14 days of microgravity. No differences existed in the profile of myosin protein isoforms or beta-myosin heavy chain mRNA in hearts between the flight and synchronous control groups. On the other hand, differences in the expression of beta-myosin heavy chain mRNA relative to the 18S and 28S rRNA in the heart between flight and synchronous control groups were noted with a covariance mapping analysis. Both the vastus intermedius and lateral gastrocnemius muscles exhibited significant decreases in skeletal alpha-actin mRNA per unit of extractable RNA in the flight group compared with the synchronous control group. However, no significant difference for skeletal alpha-actin mRNA occurred in the triceps brachii muscle between these groups. Cytochrome c mRNA per unit of extractable RNA decreased only in the vastus intermedius but not in the lateral gastrocnemius or triceps brachii muscles. In summary, changes in the pretranslational regulation of contractile protein gene expression occur in both heart and skeletal muscle after 14 days of microgravity. Author

A92-51484 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

CARDIAC MORPHOLOGY AFTER CONDITIONS OF MICROGRAVITY DURING COSMOS 2044

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Light- and electron-microscopic studies were performed on cardiac muscle from rats flown on Cosmos 2044 and from four control groups. Average cross-sectional area of myofibers was measured by video analysis of the light-microscopic images of papillary and ventricular muscle samples from all animals. This cross-sectional area was significantly decreased in flight rats ($P = 0.03$) compared with synchronous controls. Additional findings at the electron microscopic level consistent with this atrophy were obtained by stereological analysis and optical diffraction analysis of papillary muscle samples. Slightly higher mitochondrial volume density values and mitochondria-to-myofibril ratios as well as normal A-band spacings (d1,0) and Z-band spacings of myofibrils were observed in the tail-suspension and flight groups. General morphological features similar to those in ventricular samples from the previous Cosmos 1887 flight were observed. Author

A92-51485* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

PHOTOAFFINITY LABELING OF REGULATORY SUBUNITS OF PROTEIN KINASE A IN CARDIAC CELL FRACTIONS OF RATS

M. I. MEDNIEKS (Illinois, University, Chicago), I. POPOVA (Institute of Biomedical Problems, Moscow, Russia), and R. E. GRINDELAND (NASA, Ames Research Center, Moffett Field, CA) Journal of Applied Physiology, Supplement (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 101S-106S. refs
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Photoaffinity labeling in heart tissue of rats flown on Cosmos 2044 was used to measure the regulatory (R) subunits of adenosine monophosphate-dependent protein kinase. A significant decrease of RII subunits in the particulate cell fraction extract (S2; P less than 0.05 in all cases) was observed when extracts of tissue samples from vivarium controls were compared with those from flight animals. Photoaffinity labeling of the soluble fraction (S1) was observed to be unaffected by spaceflight or any of the simulation conditions. Proteins of the S2 fraction constitute a minor (less than 10 percent) component of the total, whereas the S1 fraction contained most of the cell proteins. Changes in a relatively

minor aspect of adenosine monophosphate-mediated reactions are considered to be representative of a metabolic effect. O.G.

A92-51486* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

VENTRAL HORN CELL RESPONSES TO SPACEFLIGHT AND HINDLIMB SUSPENSION

BIAN JIANG, ROLAND R. ROY, I. V. POLIAKOV, I. B. KRASNOV, and V. R. EDGERTON (California, University, Los Angeles; Medical Institute, Voronezh; Institute of Biomedical Problems, Moscow, Russia) Journal of Applied Physiology, Supplement (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 107S-111S. refs
(Contract NCC2-535)
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Ventral horn cells of the lumbosacral enlargement of the spinal cord were studied focusing on the succinate dehydrogenase (SDH) activity and cross-sectional area of the soma of ventral horn cells which were measured using a computer-aided image-processing system. The relationships between the soma size and SDH activities of lumbar ventral horn cells after 14 days of spaceflight (Cosmos 2044) or of hindlimb suspension are considered. Three groups of rats under consideration include control, 14-day spaceflight, and 14-day hindlimb suspension. Data obtained indicate that, compared to the control group, the population distribution of SDH activities in the flight rats shifted toward higher activities, whereas in the suspended rats the distribution shifted toward lower activities. The interactive effects within individual cells showed that there was a higher percentage of small cells with high SDH activities in the flight than in the control or suspended rats. It is suggested that changes in ventral horn cells were due to factors other than simply the absence of weight support. O.G.

A92-51487* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

CHANGES IN MONKEY HORIZONTAL SEMICIRCULAR CANAL AFFERENT RESPONSES AFTER SPACEFLIGHT

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Extracellular responses from single horizontal semicircular canal afferents in two rhesus monkeys were studied after recovery from a 14-day biosatellite (Cosmos 2044) orbital spaceflight. On the 1st postflight day, the mean gain for 9 different horizontal canal afferents, tested using one or several different passive yaw rotation waveforms, was nearly twice that for 20 horizontal canal afferents similarly tested during preflight and postflight control studies. Adaptation of the afferent response to passive yaw rotation on the 1st postflight day was also greater. These results suggest that at least one component of the vestibular end organ (the semicircular canals) is transiently modified after exposure to 14 days of microgravity. It is unclear whether the changes are secondary to other effects of microgravity, such as calcium loss, or an adaptive response. If the response is adaptive, then this report is the first evidence that the response of the vestibular end organ may be modified (presumably by the central nervous system via efferent connections) after prolonged unusual vestibular stimulation. If this is the case, the sites of plasticity of vestibular responses may not be exclusively within central nervous system vestibular structures, as previously believed. Author

A92-51488* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

VESTIBULOOCULAR REFLEX OF RHESUS MONKEYS AFTER SPACEFLIGHT

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Biomedical Problems, Moscow, Russia) Journal of Applied Physiology, Supplement (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 121S-131S. refs
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The vestibuloocular reflex (VOR) of two rhesus monkeys was recorded before and after 14 days of spaceflight. The gain (eye velocity/head velocity) of the horizontal VOR, tested 15 and 18 h after landing, was approximately equal to preflight values. The dominant time constant of the animal tested 15 h after landing was equivalent to that before flight. During nystagmus induced by off-vertical axis rotation (OVAR), the latency, rising time constant, steady-state eye velocity, and phase of modulation in eye velocity and eye position with respect to head position were similar in both monkeys before and after flight. There were changes in the amplitude of modulation of horizontal eye velocity during steady-state OVAR and in the ability to discharge stored activity rapidly by tilting during postrotatory nystagmus (tilt dumping) after flight: OVAR modulations were larger, and tilt dumping was lost in the one animal tested on the day of landing and for several days thereafter. If the gain and time constant of the horizontal VOR exchange in microgravity, they must revert to normal soon after landing. The changes that were observed suggest that adaptation to microgravity had caused alterations in way that the central nervous system processes otolith input. Author

A92-51489 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

ANALYSES OF PLASMA FOR METABOLIC AND HORMONAL CHANGES IN RATS FLOWN ABOARD COSMOS 2044

ALFRED H. MERRILL, JR., ELAINE WANG, RICHARD E. MULLINS, RICHARD E. GRINDELAND, and IRINA A. POPOVA (Emory University, Atlanta, GA; NASA, Ames Research Center, Moffett Field, CA; Institute of Biomedical Problems, Moscow, Russia) Journal of Applied Physiology, Supplement (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 132S-135S. Research supported by NASA. refs
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Plasmas samples from rats flown aboard Cosmos 2044 were analyzed for the levels of key metabolites, electrolytes, enzymes, and hormones. The major differences between the flight group and the synchronous control were elevations in glucose, cholesterol, phosphate, creatinine, blood urea nitrogen, lactate dehydrogenase, and aspartate aminotransferase and decreased levels of thyroxine. Most of these differences were not mimicked by tail suspension of ground-based rats; however, both flight and suspended rats exhibited inhibited testosterone secretion. Corticosterone, immunoreactive growth hormone, and prolactin showed inconsistent differences from the various control groups, suggesting that the levels of these hormones were not due to actual or simulated microgravity. Author

A92-51490* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

EFFECT OF SPACEFLIGHT ON RAT HEPATOCYTES - A MORPHOMETRIC STUDY

RICHARD N. RACINE and SUSAN M. CORMIER (Louisville, University, KY) Journal of Applied Physiology, Supplement (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 136S-141S. refs
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Hepatic tissue from flight, synchronous, vivarium, and tail-suspended rats was examined by light microscopy and computer-assisted image analysis. Glycogen levels in flight rats were found to be significantly elevated over those in controls. Lipid was also higher but not significantly different. Hepatocytes appeared larger in flight animals because of area attributed to increased glycogen. Sinusoids were less prominent in flight animals than in controls. The total Kupffer cell population appeared to be reduced in flight animals and may represent changes in defensive capacity of the liver. Alterations in the storage of glycogen and number of Kupffer cells suggest an important effect of spaceflight

on the function of the liver that may have important implications for long-term spaceflight. Author

A92-51491* National Aeronautics and Space Administration, Washington, DC.

DIFFERENCES IN GLYCOGEN, LIPIDS, AND ENZYMES IN LIVERS FROM RATS FLOWN ON COSMOS 2044

ALFRED H. MERRILL, JR., ELAINE WANG, REGINA LAROQUE, RICHARD E. MULLINS, EDWARD T. MORGAN, JAMES L. HARGROVE, HERBERT L. BONKOVSKY, and IRINA A. POPOVA (Emory University, Atlanta; Georgia, University, Athens; Massachusetts, University, Worcester; Institute of Biomedical Problems, Moscow, Russia) Journal of Applied Physiology, Supplement (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 142S-147S. Research supported by NASA. refs
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Livers from rats flown aboard Cosmos 2044 were analyzed for protein, carbohydrate (glycogen), and lipids as well as the activities of a number of key enzymes involved in metabolism of these compounds and xenobiotics. The major differences between the flight group and the synchronous control were elevations in microsomal protein, liver glycogen content, tyrosine aminotransferase, and tryptophan oxygenase and reductions in sphingolipids and the rate-limiting enzyme of heme biosynthesis delta-aminolevulinic acid synthase. These results provide further evidence that spaceflight has pronounced and diverse effects on liver function; however, some of the results with samples from Cosmos 2044 differed notably from those from previous spaceflights. This may be due to conditions of spaceflight and/or the postflight recovery period for Cosmos 2044. Author

A92-51492

PROLIFERATION OF JEJUNAL MUCOSAL CELLS IN RATS FLOWN IN SPACE

H. R. SAWYER, C. L. MOELLER, R. W. PHILLIPS (Colorado State University, Fort Collins), and K. L. SMIRNOV (Institute of Biomedical Problems, Moscow, Russia) Journal of Applied Physiology, Supplement (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 148S-150S. refs
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To examine the effects of spaceflight on the proliferation and turn-over of jejunal mucosal cells, a comparison is made of the percentages of mitotic cells present in the crypts of Lieberkuehn in the proximal, middle, and distal jejunum in each of five rats flown on the Cosmos 2044 mission and in rats included in the vivarium, synchronous, and caudal-elevated groups. On the basis of the data obtained, there was no difference in mitotic indexes between animals in the flight and vivarium (ground control) groups. Thus it appears that the ability of jejunal mucosal cells to proliferate is not affected by microgravity conditions associated with spaceflight. Although the length of villi and depth of crypts were reduced in flight animals compared with those in the vivarium group, the observed reduction is probably attributable to changes in the connective tissue core of villi and is not likely due to an impairment of the proliferation and migration of jejunal mucosal cells. Author

A92-51493 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

EFFECTS OF SPACEFLIGHT ON RAT PITUITARY CELL FUNCTION

W. C. HYMER, R. GRINDELAND, I. KRASNOV, I. VIKTOROV, K. MOTTER, P. MUKHERJEE, K. SHELLENBERGER, and M. VASQUES (Pennsylvania State University, University Park; NASA, Ames Research Center, Moffett Field, CA; Brain Research Institute and Institute of Biomedical Problems, Moscow, Russia) Journal of Applied Physiology, Supplement (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 151S-157S. Previously announced in STAR as N92-16544. refs
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The secretory capacity of growth hormone (GH) and prolactin

(PRL) cells prepared from rats flown in space on the 12.5 day mission of Cosmos 1887 and the 14 day mission of Cosmos 2044 was evaluated in several post-flight tests on earth. The results showed statistically significant and repeatable decrements in hormone release, especially when biological assays (rather than immunological assays) were used in the tests. Significant and repeatable intracellular changes in GH cells from the flight animals were also found; most important were increases in the GH-specific cytoplasmic staining intensities and cytoplasmic areas occupied by hormone. Tail suspension of rats for 14 days, an established model for mimicking musculo-skeletal changes seen in spaceflown rats, results in some changes in GH and PRL cell function that were similar to those from spaceflown animals. Our results add to a growing body of data that described deconditioning of physiological systems in spaceflight and provide insights into the time frame that might be required for readaptation of the GH/PRL cell system upon return to earth. Author

A92-51494* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

EFFECTS OF SPACEFLIGHT ON HYPOTHALAMIC PEPTIDE SYSTEMS CONTROLLING PITUITARY GROWTH HORMONE DYNAMICS

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Possible effects of reduced gravity on central hypophyseotropic systems controlling growth hormone (GH) secretion were investigated in rats flown on Cosmos 1887 and 2044 biosatellites. Immunohistochemical (IHC) staining for the growth hormone-releasing factor (GRF), somatostatin (SS), and other hypothalamic hormones was performed on hypothalami obtained from rats. IHC analysis was complemented by quantitative in situ assessments of mRNAs encoding the precursors for these hormones. Data obtained suggest that exposure to microgravity causes a preferential reduction in GRF peptide and mRNA levels in hypophyseotropic neurons, which may contribute to impaired GH secretion in animals subjected to spaceflight. Effects of weightlessness are not mimicked by hindlimb suspension in this system. O.G.

A92-51495* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

PITUITARY OXYTOCIN AND VASOPRESSIN CONTENT OF RATS FLOWN ON COSMOS 2044

L. KEIL, J. EVANS, R. GRINDELAND (NASA, Ames Research Center, Moffett Field, CA), and I. KRASNOV (Institute of Biomedical Problems, Moscow, Russia) *Journal of Applied Physiology, Supplement* (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 166S-168S. refs

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Preliminary studies in rats (COSMOS 1887) suggested that levels of posterior pituitary hormones were reduced by exposure to spaceflight. To confirm these preliminary findings, pituitary tissue from rats flown for 14 days on Cosmos 2044 is obtained. Posterior pituitary content of oxytocin (OT) and vasopressin (VP) were measured in these tissues as well as those from ground-based controls. The synchronous control group had feeding and lighting schedules synchronized to those in the spacecraft and were maintained in flight-type cages. Another group was housed in vivarium cages; a third group was tail suspended (T), a method used to simulate microgravity. Flight rats showed an average reduction of 27 in pituitary OT and VP compared with the three control groups. When hormone content was expressed in terms of pituitary protein (microg hormone/mg protein), the average decrease in OT and VP for the flight animals ranged from 20 to 33 percent compared with the various control groups. Reduced levels of pituitary OT and VP were similar to preliminary

measurements from the Cosmos 1887 mission and appear to result from exposure to spaceflight. These data suggest that changes in the rate of hormone secretion or synthesis may have occurred during exposure to microgravity. Author

A92-51496 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

CIRCULATING PARATHYROID HORMONE AND CALCITONIN IN RATS AFTER SPACEFLIGHT

SARA B. ARNAUD, PAUL FUNG, IRINA A. POPOVA, EMILY R. MOREY-HOLTON, and RICHARD E. GRINDELAND (NASA, Ames Research Center, Moffett Field, CA; Institute of Biomedical Problems, Moscow, Russia) *Journal of Applied Physiology, Supplement* (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 169S-173S. refs

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Parathyroid hormone and calcitonin, two major calcium-regulating hormones, were measured in the plasma of five experimental groups of rats to evaluate postflight calcium homeostasis after the 14-day Cosmos 2044 flight. Parathyroid hormone values were slightly higher in the flight animals (F) than in the appropriate cage and diet controls (S) (44 ± 21 vs 21 ± 4 pg/ml, P less than 0.05), but they were the same as in the vivarium controls (V), which had different housing and feeding schedules. The difference in F and V (22 ± 11 vs 49 ± 16 pg/ml, P less than 0.05) was most likely due to failure of circulating calcitonin in F to show the normal age-dependent increase which was demonstrated in age-matched controls in a separate experiment. Basal values for parathyroid hormone and calcitonin were unchanged after 2 wk of hindlimb suspension, a flight simulation model, in age-matched and younger rats. From a time course experiment serum calcium was higher and parathyroid hormone lower after 4 wk than in ambulatory controls. Postflight circulating levels of parathyroid hormone appear to reflect disturbances in calcium homeostasis from impaired renal function of undetermined cause, whereas levels of calcitonin reflect depression of a normal growth process. Author

A92-51497 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

EFFECTS OF MICROGRAVITY OR SIMULATED LAUNCH ON TESTICULAR FUNCTION IN RATS

R. P. AMANN, D. R. DEEVER, B. R. ZIRKIN, G. S. GRILLS, W. J. SAPP, D. N. R. VEERAMACHANENI, J. W. CLEMENS, S. D. BANERJEE, J. FOLMER, C. M. GRUPPI (Colorado State University, Fort Collins; Pennsylvania State University, University Park; Johns Hopkins University, Baltimore, MD; Columbia University, New York; Tuskegee University, AL) et al. *Journal of Applied Physiology, Supplement* (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 174S-185S. refs

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Reproductive toxicology and cellular and molecular biology approaches were used to evaluate testicular function in rats from Cosmos 2044. It is found that concentrations of testosterone in testicular tissue or peripheral blood plasma were reduced in flight rates to less than 20 percent of values for simulated-launch or vivarium controls. Spermatogenesis was essentially normal in flight rats, but production of testosterone was severely depressed. O.G.

A92-51498* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

EFFECT OF SPACEFLIGHT ON LYMPHOCYTE PROLIFERATION AND INTERLEUKIN-2 PRODUCTION

PATRICIA V. NASH, IRINA V. KONSTANTINOVA, BORIS B. FUCHS, ALEXANDR L. RAKHMILEVICH, A. T. LESNIAK, and ANDREA M. MASTRO (Pennsylvania State University, University Park; Institute of Biomedical Problems; Russian Academy of

Medical Sciences, Institute of Human Morphology, Moscow, Russia) Journal of Applied Physiology, Supplement (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 186S-190S. refs (Contract NAG2-599)
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In this study, inguinal lymph node lymphocytes from rats flown on the Cosmos 2044 mission were tested for proliferation and interleukin-2 (IL-2) production. Cells cultured with mitogenic lectins, phorbol ester, and calcium ionophore, or T-cell mitogen and lymphokine, were assayed for DNA synthesis by (H-3) thymidine incorporation. Lymphocytes incubated with a T-cell mitogen alone also were tested for IL-2 production. Proliferation of lymphocytes from flight rats was not significantly different from controls for any of the mitogens tested. Furthermore, lymph node lymphocytes from control and flown rats produced similar amounts of IL-23. Thus microgravity may act on lymphocytes in a tissue-specific manner, a new finding that could impact on the evaluation of spaceflight effects on immunocompetence. Author

A92-51499 National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

SPACEFLIGHT ALTERS IMMUNE CELL FUNCTION AND DISTRIBUTION

GERALD SONNENFELD, ADRIAN D. MANDEL, IRINA V. KONSTANTINOVA, WALLACE D. BERRY, GERALD R. TAYLOR, A. T. LESNIAK, BORIS B. FUCHS, and ALEXANDER L. RAKHMELEVICH (Louisville, University, KY; NASA, Ames Research Center, Moffett Field, CA; NASA, Johnson Space Center, Houston, TX; Institute of Biomedical Problems; Russian Academy of Medical Sciences, Institute of Human Morphology, Moscow, Russia) Journal of Applied Physiology, Supplement (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 191S-195S. refs (Contract NAG2-614)
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Experiments are described which were performed onboard Cosmos 2044 to determine spaceflight effects on immunologically important cell function and distribution. Results indicate that bone marrow cells from flown and suspended rats exhibited a decreased response to a granulocyte/monocyte colony-stimulating factor compared with the bone marrow cells from control rats. Bone marrow cells showed an increase in the percentage of cells expressing markers for helper T-cells in the myelogenous population and increased percentages of anti-asialo granulocyte/monocyte-1-bearing interleukin-2 receptor bearing pan T- and helper T-cells in the lymphocytic population. O.G.

A92-51500 National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

EFFECT OF SPACEFLIGHT ON NATURAL KILLER CELL ACTIVITY

MARINA P. RYKOVA, GERALD SONNENFELD, A. T. LESNIAK, GERALD R. TAYLOR, DIMITRII O. MESHKOV, ADRIAN D. MANDEL, ANDREI E. MEDVEDEV, WALLACE D. BERRY, BORIS B. FUCHS, and IRINA V. KONSTANTINOVA (Institute of Biomedical Problems; Russian Academy of Medical Sciences, Institute of Human Morphology, Moscow, Russia; Louisville, University, KY; NASA, Johnson Space Center, Houston, TX; NASA, Ames Research Center, Moffett Field, CA) Journal of Applied Physiology, Supplement (ISSN 8750-7587), vol. 73, no. 2, Aug. 1992, p. 196S-200S. refs (Contract NAG2-614)
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The effects of spaceflight on immune cell function were determined in rats flown on Cosmos 2044. Control groups included vivarium, synchronous, and antithrostatically suspended rats. The ability of natural killer cells to lyse two different target cell lines was determined. Spleen and bone marrow cells obtained from flight rats showed significantly inhibited cytotoxicity for YAC-1 target cells compared with cells from synchronous control rats. This could have been due to exposure of the rats to microgravity. Antithrostatic suspension did not affect the level of cytotoxicity from spleen cells of suspended rats for YAC-1 cells. On the other hand, cells from rats flown in space showed no significant

differences from vivarium and synchronous control rats in cytotoxicity for K-562 target cells. Binding of natural killer cells to K-562 target cells was unaffected by spaceflight. Antithrostatic suspension resulted in higher levels of cytotoxicity from spleen cells for Cr-51-labeled K-562 cells. The results indicate differential effects of spaceflight on function of natural killer cells. This shows that spaceflight has selective effects on the immune response. Author

A92-52385

FROM GRAVITY AND THE ORGANISM TO GRAVITY AND THE CELL

ALLAN H. BROWN (Gravitational Plant Physiology Laboratory, Philadelphia, PA) ASGSB Bulletin (ISSN 0898-4697), vol. 4, no. 2, July 1991, p. 7-18. refs
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A survey is conducted of the current understanding of the effects exerted by gravity on the functioning of living systems. Much more is currently known about the roles of organic and inorganic substances employed by plants in information transfer and growth regulation than when the 'Gravity and the Organism' conference was held in 1968. The 'local control' concept, according to which the regulation of responses depends on plasmodesmata and gap junctions which allow plants and animals to throttle the transport of growth regulators across tissue boundaries, has been widely accepted. It is noted that experimental research efforts in gravitational physiology remain dependent on exploratory studies requiring manipulation of test-subjects' g-force environment. Attention is given to dominant trends in research. O.C.

A92-52387

POSSIBLE MECHANISMS OF INDIRECT GRAVITY SENSING BY CELLS

GUENTER ALBRECHT-BUEHLER (Northwestern University, Chicago, IL) ASGSB Bulletin (ISSN 0898-4697), vol. 4, no. 2, July 1991, p. 25-34. refs
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The weight of single normal-sized cells (approximately 10 microns in diameter) is too small compared with other cellular forces to allow them the distinction between up and down. However, the weight of the surrounding medium is much larger. Cells may be able to sense certain environmental changes caused by gravity and thus may sense indirectly at least the amplitude of gravitational forces. In particular, the fluid environment of the cell can be expected at normal gravity to support microconvective currents that cease to flow at microgravity. Thus, the absence of gravity may be transduced into the accumulation of metabolites and ions from the cells and depletion of fresh nutrients. These changes, in turn, can affect the contacts of cells, their membrane potential, their cytoskeleton, and thus, ultimately, their behavior. As to ground-based simulations of microgravity, the above considerations suggest that the averaging of the vectorial force of gravity in clinorotation is inadequate for simulation because it may actually increase rather than suppress convective mixing above the normal levels. Author

A92-52388* National Aeronautics and Space Administration, Washington, DC.

GRAVITY DEPENDENT PROCESSES AND INTRACELLULAR MOTION

PAUL TODD (NIST, Boulder, CO) ASGSB Bulletin (ISSN 0898-4697), vol. 4, no. 2, July 1991, p. 35-39. Research supported by NASA. refs

Most organelles large enough to sediment or to undergo isothermal settling within eukaryotic cells are held in position by one or more components of the cytoskeleton. The interior of eukaryotic cells is considered to be very crowded, and the evaluation of natural-convective processes is very difficult. In a most simple view, the cell may be considered as consisting of four immiscible phases among which solutes are exchanged causing steep concentration gradients and thermodynamic conditions far from equilibrium. Extracellular gravity-related forces

may include natural convection due to solute gradients external to single cells or the work performed by swimming, ciliated, or elongating cells. Author

A92-52389

GRAVITY SENSING MECHANISMS IN PLANT CELLS

ANDREAS SIEVERS (Bonn, Universitaet, Germany) ASGSB Bulletin (ISSN 0898-4697), vol. 4, no. 2, July 1991, p. 43-50. Research supported by DFG, BMFT, and Ministerium fuer Wissenschaft und Forschung. refs
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Sensing of gravity is essential for the survival of plant seedlings. Therefore it is understandable that gravistimulation of only 0.5 sec-duration causes a graviresponse. The earliest graviresponses could be measured within seconds as alterations in membrane potentials of the statocytes in the root cap. Root statocytes are polarly organized. From a 6-day microgravity experiment in the Spacelab D1 Mission it has been concluded that the observed polar differentiation is a result of a genetically prepatterned developmental program. Statoliths, the sedimentable organelles of statocytes, are surrounded by actin filaments which partly keep them in position. Under 6 min of microgravity during parabolic flights of rockets, it could be demonstrated that the statoliths moved in the opposite direction to the initial gravity vector. It is concluded that shearing forces are exerted by microfilaments. It is supposed that the change of the position of statoliths is transmitted to gravisensitive structures of the statocytes via microfilaments. As gravi-perception is influenced by calcium ions, it is suggested that these interactions regulate the activity of ion channels and/or pumps in the membranes thus initiating the graviresponse chain. Author

A92-52390

CELL BIOPHYSICS AND PLANT GRAVITROPISM

ROBERT S. BANDURSKI (Michigan State University, East Lansing) ASGSB Bulletin (ISSN 0898-4697), vol. 4, no. 2, July 1991, p. 51-64. refs
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After receiving an environmental stimulus, a biological organism undergoes membrane depolarization and releases messenger molecules which effect the organism's response. This working hypothesis is presently elaborated for the case of corn seedlings' response to gravitational stimulus. After the gravitational vector is perceived by a statolith or other sensor, ion and hormone gating channels that connect vascular to surrounding tissues are depolarized; the asymmetrically released ions and hormones initiate a cascade of reactions resulting in asymmetric growth. Attention is given to mechanisms for the amplification of the weak gravity signal, and an experimental basis for distinguishing between statolithic and other detector mechanisms is presented. O.C.

A92-52391* National Aeronautics and Space Administration, Washington, DC.

EMBRYOGENIC PLANT CELLS IN MICROGRAVITY

ABRAHAM D. KRIKORIAN (New York, State University, Stony Brook) ASGSB Bulletin (ISSN 0898-4697), vol. 4, no. 2, July 1991, p. 65-72. Research supported by NASA. refs
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In view of circumstantial evidence for the role of gravity (g) in shaping the embryo environment, normal embryo development may not occur reliably and efficiently in the microgravity environment of space. Attention must accordingly be given to those aspects of higher plant reproductive biology in space environments required for the production of viable embryos in a 'seed to seed to seed' experiment. It is suggested that cultured cells can be grown to be morphogenetically competent, and can be evaluated as to their ability to simulate embryogenic events usually associated with fertilized eggs in the embryo sac of the ovule in the ovary. O.C.

A92-52392

CHEMOTACTIC MOVEMENT OF SINGLE CELLS

ROBERT T. TRANQUILLO (Minnesota, University, Minneapolis)

ASGSB Bulletin (ISSN 0898-4697), vol. 4, no. 2, July 1991, p. 75-85. refs

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A stochastic mathematical model for cell chemosensory movement is developed that has its basis in the kinetic fluctuations of attractant-receptor binding, and can both simulate cell paths in uniform and graded concentrations and quantitatively predict the persistence in uniform attractant concentrations or the orientation bias in gradients. Model predictions are consistent with data for neutrophils responding to chemotactic peptide; the model analysis elucidates the way in which persistence time and orientation bias depend on model parameters associated with receptor binding, receptor signal transduction, and cell turning response. O.C.

A92-52393

SHEAR FORCE AND ITS EFFECT ON CELL STRUCTURE AND FUNCTION

ROBERT M. NEREM (Georgia Institute of Technology, Atlanta) ASGSB Bulletin (ISSN 0898-4697), vol. 4, no. 2, July 1991, p. 87-94. refs

(Contract NIH-HL-26890)

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Cell culture studies of the influence of a laminar flow and the associated wall shear stress on bovine aortic endothelial cells are reviewed. These experiments, taken together with those of others, demonstrate that in response to a steady state flow the cells elongate in shape, orient their major axis with the direction of flow, and reorganize their F-actin structure, with a concomitant increase in cell stiffness. There also is an influence of flow on cell function, including the ability to replicate, to secrete vasoactive substances, and on such processes as endocytosis. Such effects of flow are dependent on the level of shear stress, the duration of exposure, the surface to which the cells are adherent, and the media employed. Furthermore, the use of a 1 Hz sinusoidal, nonreversing pulsatile flow was found to enhance the effects observed for a steady state flow. Although these studies were motivated by an interest in investigating the role of flow in the initiation and progression of atherosclerosis, the results obtained provide evidence that relatively small physical forces can have an important influence. This indicates that cell biology experiments on orbit need to be conducted under conditions where the influence of other forces, e.g., those due to a flowing cell culture system, are negligible. Author

A92-52394

THE DYNAMICS OF UNICELLULAR SWIMMING ORGANISMS

JOHN O. KESSLER (Arizona, University, Tucson) ASGSB Bulletin (ISSN 0898-4697), vol. 4, no. 2, July 1991, p. 97-105. Research supported by University of Arizona Foundation. refs
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Swimming microorganisms, such as motile algal cells, are oriented passively by gravity and also by velocity gradients of the fluid which surrounds them. They may actively orient themselves as well, in response to sensory signals such as illumination. These axial alignments are degraded by molecular collisions which generate rotational Brownian motion and by endogenously generated random turning behavior. The geometry of the track traced out by an individual cell's swimming is governed by the joint competitive action of these orienting influences. These determinants of the cell trajectories are considered. It is also shown that, although gravity may not directly interact with cell metabolism, it can affect the energy consumption accompanying taxis, by suppressing pathway tortuosity and by supplying an orientational bias. This paper also reviews the role of gravity in organizing patterns - collective modes of the fluid and of the suspended swimmers which energize the dynamics. Author

A92-52396

DETECTION OF GRAVITY THROUGH NONEQUILIBRIUM MECHANISMS

DILIP K. KONDEPUDI (Wake Forest University, Winston-Salem, NC) ASGSB Bulletin (ISSN 0898-4697), vol. 4, no. 2, July 1991,

p. 119-124. refs

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The present consideration of a dynamic gravity-sensing mechanism that is not in thermodynamic equilibrium indicates that, under some conditions, such nonequilibrium systems can be more sensitive than equilibrium systems. The present dynamic mechanism responds to gravity on the basis of a process analogous to that of 'signal averaging' for electronic weak-signal detection. By means of such a process, a system is able to respond to a small systematic force that is embedded in a larger, but randomly fluctuating force. O.C.

A92-52397

ENZYMATIC CATALYSIS IN ORGANIC MEDIA - FUNDAMENTALS AND SELECTED APPLICATIONS

JONATHAN S. DORDICK (Iowa, University, Iowa City) ASGSB Bulletin (ISSN 0898-4697), vol. 4, no. 2, July 1991, p. 125-132. Research supported by Mead Corp. and NSF. refs

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The use of enzymes in organic solvents significantly extends conventional aqueous-based biocatalysis. This field is reviewed with respect to the salient factors that govern enzymatic catalysis in nonaqueous media. Specific examples of peroxidase catalysis in organic media are discussed (e.g., phenolic polymerizations and enzymic temperature abuse sensors). Given that membranous parts of a cell are highly nonaqueous in character, the study of enzymes in poorly hydrated media may provide clues as to the function of membrane-bound enzymes and their response to different gravitational forces. Author

A92-52398

THE STUDY OF CELLS BY OPTICAL TRAPPING AND MANIPULATION OF LIVING CELLS USING INFRARED LASER BEAMS

ARTHUR ASHKIN (AT&T Bell Laboratories, Holmdel, NJ) ASGSB Bulletin (ISSN 0898-4697), vol. 4, no. 2, July 1991, p. 133-146. refs

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The new technique of optical trapping and manipulation of living cells using the forces of radiation pressure from infrared single beam gradient laser traps is reviewed. These traps, also referred to as 'optical tweezers', are capable of stably trapping transparent micron and submicron biological particles free of optical damage. Entire cells or organelles within the interior of living cells can be manipulated without damaging the cell wall. The trap is built into a high resolution microscope for combined trapping and high resolution viewing. Experiments demonstrating reproduction of motile bacteria and yeast cells within infrared traps and manipulations of plant and animal cells are discussed. Applications to the study of the mechanical properties of cell cytoplasm, study of cell function, and cell separation and orientation are considered. The ability to apply controlled light forces on cells of magnitude comparable to or often much greater than gravity suggests that these optical techniques might have relevance to experiments showing the influence of gravity on cells. Author

A92-52399

SUMMARY OF BIOLOGICAL SPACEFLIGHT EXPERIMENTS WITH CELLS

KATHERINE J. DICKSON (George Washington University, Washington) ASGSB Bulletin (ISSN 0898-4697), vol. 4, no. 2, July 1991, p. 151-260. refs

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A comprehensive tabulation and bibliographic compilation is presented for the numerous biological experiments that have been performed in space microgravity conditions. These experiments encompass those involving viruses, bacteriophage, unicellular organisms, lower fungi, and animal cell and plant tissue cultures, while excluding studies of postflight-dissected whole organisms and fertilized eggs. Also excluded are experiments in biotechnology (cell purification and fusion, etc.). Experiments flown aboard sounding rockets, manned spacecraft, space stations, and biosatellites are included. O.C.

A92-52955

A SMALL METALLORIBOZYME WITH A TWO-STEP MECHANISM

TAO PAN and OLKE C. UHLENBECK (Colorado, University, Boulder) Nature (ISSN 0028-0836), vol. 358, no. 6387, Aug. 13, 1992, p. 560-563. Research supported by NIH, Damon Runyon-Walter Winchell Cancer Research Fund, and W.M. Keck Foundation. refs

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An RNA molecule consisting of an asymmetric internal loop of six nucleotides can be rapidly and specifically cleaved by Pb(2+) in the presence of Mg(2+). The 5' cleavage product terminates with a 3' phosphomonoester generated from a 2',3'-cyclic phosphodiester reaction intermediate. This two-step reaction mechanism resembles that of many protein ribonucleases but has not previously been observed for reactions catalyzed by RNA. Author

A92-53003

ADAPTATION AND ITS LIMITATIONS IN EXTREME ENVIRONMENTS - THE CASE OF A COLD ENVIRONMENT

AKIHIRO KUROSHIMA (Asahikawa Medical College, Japan) Japanese Journal of Aerospace and Environmental Medicine (ISSN 0387-0723), vol. 29, no. 1, March 1992, p. 22-25. In Japanese. refs

Copyright

Hypothermia and physiological functional changes of the human body in cold environments are considered. The cold adaptation conditions are examined, and the relationship between ambient temperature and metabolic rate is analyzed. The difference between ambient and rectal temperature for different species is discussed. Y.P.Q.

N92-30305*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

COMPARISON OF EPIFLUORESCENT VIABLE BACTERIAL COUNT METHODS

E. B. RODGERS and T. L. HUFF (Sverdrup Technology, Inc., Huntsville, AL.) Jul. 1992 17 p (NASA-TM-103592; NAS 1.15:103592) Avail: CASI HC A03/MF A01

Two methods, the 2-(4-iodophenyl) 3-(4-nitrophenyl) 5-phenyltetrazolium chloride (INT) method and the direct viable count (DVC), were tested and compared for their efficiency for the determination of the viability of bacterial populations. Use of the INT method results in the formation of a dark spot within each respiring cell. The DVC method results in elongation or swelling of growing cells that are rendered incapable of cell division. Although both methods are subjective and can result in false positive results, the DVC method is best suited to analysis of waters in which the number of different types of organisms present in the same sample is assumed to be small, such as processed waters. The advantages and disadvantages of each method are discussed. Author

N92-30368# Arizona State Univ., Tempe.

PHOTOINITIATED ELECTRON TRANSFER IN MULTICHROMOPHORIC SPECIES: SYNTHETIC TETRADES AND PENTADS FEATURING DIQUINONE MOIETIES

30 Apr. 1992 15 p (Contract DE-FG02-87ER-13791) (DE92-013472; DOE/ER-13791/37) Avail: CASI HC A03/MF A01

This project involves the design, synthesis, and photophysical study of complex molecular systems engineered to achieve long lived charge separated states by a biomimetic, photoinitiated multistep electron transfer process. The use of these artificial systems to investigate different electron and energy transfer strategies allow the evolution of more efficient molecular devices for the gathering of light energy and its transformation into chemical potential energy. The three major aspects of the work emphasized in the initial proposal are: design and synthesis of molecular devices incorporating new quinone moieties; synthesis and spectroscopic

studies of molecular tetrads and pentads featuring modified porphyrin-diquinone linkages; and new photochemical and photophysical investigations of tetrads and pentads, including the development of methods for harvesting the energy stored in long-lived charge separated states. DOE

N92-30531# Pennsylvania State Univ., University Park. Dept. of Chemistry.

VOLTAMMETRIC MEASUREMENT OF OXYGEN IN SINGLE NEURONS USING PLATINIZED CARBON RING ELECTRODES

YAU Y. LAU, TAKAYUKI ABE, and ANDREW G. EWING 10 Jan. 1992 23 p

(Contract N00014-90-J-1161)

(AD-A252191; TR-011) Avail: CASI HC A02/MF A01

Nafion-coated ultrasmall platinum ring electrodes have been implanted in the giant dopamine neuron of the pond snail, *Planorbis corneus*, and the oxygen concentration inside these single neurons has been estimated. Experimental data suggest that the intracellular oxygen level in the identified dopamine neuron of *Planorbis corneus* is approximately 0.032 mM. The oxygen concentration immediately outside the cell (approx. 10 micro m away from the cell) is 0.041 mM. Furthermore, staircase voltammetry can be used to monitor dynamic changes in oxygen concentration inside the cell after bathing in Ringer's solution saturated with air/oxygen. Data obtained for intracellular oxygen concentrations suggest that intracellular oxygen consumption is increased following potassium chloride-induced stimulation of these cells. GRA

N92-30829# Nebraska Univ., Lincoln.

ELECTROCHEMICAL AND OPTICAL STUDIES OF MODEL PHOTOSYNTHETIC SYSTEMS

15 Jan. 1992 10 p

(Contract DE-FG02-84ER-13261)

(DE92-010657; DOE/ER-13261/6) Avail: CASI HC A02/MF A01

The objective of this research is to obtain a better understanding of the relationship between the structural organization of photosynthetic pigments and their spectroscopic and electrochemical properties. Defined model systems were studied first. These included the least ordered (solutions) through the most highly ordered (Langmuir-Blodgett (LB) monolayers and self-assembled monolayers) systems containing BChl, BPheo, and UQ. Molecules other than the photosynthetic pigments and quinones were also examined, including chromophores (i.e. surface active cyanine dyes and phthalocyanines) and redox active compounds (methyl viologen (MV) and surfactant ferrocenes), in order to develop the techniques needed to study the photosynthetic components. Because the chlorophylls are photosensitive and labile, it was easier first to develop procedures using stable species. Three different techniques were used to characterize these model systems. These included electrochemical techniques for determining the standard oxidation and reduction potentials of the photosynthetic components as well as methods for determining the heterogeneous electron transfer rate constants for BChl and BPheo at metal electrodes (Pt and Au). Resonance Raman (RR) and surface enhanced resonance Raman (SERR) spectroscopy were used to determine the spectra of the photosynthetic pigments and model compounds. SERRS was also used to study several types of photosynthetic preparations. DOE

N92-31152# Norwegian Defence Research Establishment, Kjeller.

THE PROPERTIES OF THE UPTAKE SYSTEM FOR GLYCINE IN SYNAPTIC VESICLES Thesis

HEGE CHRISTENSEN 20 May 1992 71 p

(ISSN-0800-4412; NDRE/PUBL-92/1001) Avail: CASI HC

A04/MF A01

The present study provides evidence for the presence of a temperature sensitive and energy dependent uptake mechanism for glycine in synaptic vesicles isolated from rat spinal cord. The in vitro uptake of glycine in synaptic vesicles was driven by an electrochemical proton gradient generated by a Mg(sup 2+)-ATPase in the vesicle membrane. The properties of the vesicular uptake of glycine in spinal cord were clearly different

from those of the plasma membrane uptake of glycine, both with respect to Na(+), Mg(sup 2+) and ATP dependence and the developmental time course. Surprisingly glycine was also taken up by vesicles from whole brain, including cerebral cortex, and the GABA/glycine uptake ratios in different brain regions and spinal cord were similar and very different from the corresponding synaptosomal uptake ratios. These results indicate that glycine was taken up by non-glycinergic vesicles, and the finding that glycine and GABA competitively inhibited each others uptake into vesicles from brain and spinal cord, indicates that GABA and glycine may be taken up by the same vesicle population. Uptake of glutamate, GABA and glycine in synaptic vesicles from CNS was shown to increase during development, probably in parallel with synaptogenesis, and this indicates a functional role of uptake of the three amino acids by synaptic vesicles in the nerve terminals. Author

N92-31302# Northwestern Univ., Chicago, IL. Dept. of Cellular Molecular and Structural Biology.

CELLULAR LOCALIZATION OF INFRARED SOURCES Final Report, 12 Jan. 1989 - 11 Jan. 1992

GUENTER ALBRECHT-BUEHLER 1 Jan. 1992 3 p

(Contract MIPR-122-89; MIPR-113-90)

(AD-A249795; ARO-26385.6-LS) Avail: CASI HC A01/MF A01

During the past grant period we developed a special phase-contrast light microscope with an infrared spot illuminator. Using this microscope, we were able to show that cultured mammalian tissue cells such as 3T3 cells appeared capable of locating distant, microscopic infrared light sources and aiming for them. The strongest responses were observed if the infrared light sources emitted light of wavelengths in the range of 800-900 nm intermittently at rates of 30-60 pulses per min. In addition, we found that the irradiation of small spots of the cell body induced one or several changes of cell polarity in locomoting 3T3 cells. This kind of infrared 'vision' of single cells has never been observed before. It may have important conceptual implications for our approach to eukaryotic cells as well as practical implications for the control of wound healing and metastasis. GRA

N92-31465# Wayne State Univ., Detroit, MI. Dept. of Biochemistry.

EVOLUTION AND ANALYSIS OF THE FUNCTIONAL DOMAINS OF THE CHIMERIC PROTEINS THAT INITIATE PYRIMIDINE BIOSYNTHESIS Final Report, 1 Dec. 1986 - 31 Jul. 1990

DAVID R. EVANS 10 Jan. 1992 10 p

(Contract N00014-87-K-0081; NR PROJ. RR0-4106)

(AD-A250069) Avail: CASI HC A02/MF A01

The objective of this project is to test the hypothesis that the complex proteins with novel functions arose in the course of evolution by combining structural domains having partial functions. The research focuses on the enzymes that catalyze de novo pyrimidine biosynthesis. While the reactions are the same in most organisms, there are striking differences in the structure and regulation of these enzymes. This year we completed the sequence of the mammalian protein CAD, a 243 kDa polypeptide which carries glutamine dependent (GLN) carbamyl phosphate synthetase (CPS), aspartate transcarbamylase (ATC) and dihydroorotase (DHO) activities. Phylogenetic analysis suggests that the mammalian chimeric protein was formed by stepwise translocation and fusion of ancestral genes that occurred prior to the major radiation that lead to fungi, plants, and animals. The sequence divergence suggests that the fused and monofunctional DHO domains have a different evolutionary history. In contrast, sequence studies and molecular modeling of the mammalian ATC domain and a reexamination of the subunit structure of a class A ATCase, thought to have a radically different structure, showed that the ATCase catalytic domain is a trimer of identical 34 kDa polypeptides that has been highly conserved throughout the course of evolution. GRA

N92-31590# Wright State Univ., Dayton, OH. Dept. of Chemistry.

A STUDY OF THE EFFECT OF HYDROCARBON STRUCTURE ON THE INDUCTION OF MALE RAT NEPHROPATHY AND METABOLITE STRUCTURE Annual Report, 1 Jun. 1991 - 31 May 1992

M. P. SERVE 31 May 1992 5 p
(Contract AF-AFOSR-0396-89)

(AD-A252192; AFOSR-92-0559TR) Avail: CASI HC A02/MF A01

Male Fischer 344 rats were dosed with the saturated branched chain hydrocarbon 3-methylheptane. Pathological examination of the kidneys of the dosed animals compared to the kidneys of control rats dosed with water indicated that there was a noticeable difference in the ability of the hydrocarbon to induce the classic nephrotoxicity produced by 2,2,4-trimethylpentane and other branched chain hydrocarbons. Hyaline droplet formation was used as the principal indicator of kidney damage. There was little indication of any cast formation in the corticomedullary junction area of the kidney. Identification of the rat urinary metabolites of 3-methylheptane yielded 3,5-diethyl 2,3-dihydrofuran, 3-ethyl-6-methyl 2,3-dihydropyran, 3-methyl-2-heptanol, 5-methyl-2-heptanol, 2-n-butyl 1,3-butanediol, 2-ethyl 1,3-hexanediol, B-methyl-8-enantholactone, 3-methyl 3,4-heptanediol, 3-methyl 2,3-heptanediol, 3-methyl 3,5-heptanediol, 2-ethyl 1,4-hexanediol, 8-methyl-8-enantholactone, 5-methyl 2,5-heptanediol, 2-ethyl 1,5-hexanediol and 2-ethyl-11-hexanoic acid.

GRA

N92-31711# Pacific Northwest Lab., Richland, WA.
STATIC MAGNETIC FIELDS: A SUMMARY OF BIOLOGICAL INTERACTIONS, POTENTIAL HEALTH EFFECTS, AND EXPOSURE GUIDELINES

T. S. TENFORDE May 1992 19 p Presented at the 8th International Radiation Protection Association (IRPA) World Congress, Vancouver (Canada), 10-22 May 1992

(Contract DE-AC06-76RL-01830)

(DE92-015218; PNL-SA-20340; CONF-920501-22) Avail: CASI HC A03/MF A01

Interest in the mechanisms of interaction and the biological effects of static magnetic fields has increased significantly during the past two decades as a result of the growing number of applications of these fields in research, industry and medicine. A major stimulus for research on the bioeffects of static magnetic fields has been the effort to develop new technologies for energy production and storage that utilize intense magnetic fields (e.g., thermonuclear fusion reactors and superconducting magnet energy storage devices). Interest in the possible biological interactions and health effects of static magnetic fields has also been increased as a result of recent developments in magnetic levitation as a mode of public transportation. In addition, the rapid emergence of magnetic resonance imaging as a new clinical diagnostic procedure has, in recent years, provided a strong rationale for defining the possible biological effects of magnetic fields with high flux densities. In this review, the principal interaction mechanisms of static magnetic fields will be described, and a summary will be given of the present state of knowledge of the biological, environmental, and human health effects of these fields.

DOE

N92-31747# Columbia Univ., New York, NY. Center for Radiological Research.

THE RADIOLOGICAL RESEARCH ACCELERATOR FACILITY

E. J. HALL May 1992 21 p

(Contract DE-FG02-88ER-60631)

(DE92-013674; DOE/ER-60631/9) Avail: CASI HC A03/MF A01

The Radiological Research Accelerator Facility (RARAF) is based on a 4-MV Van de Graaff accelerator, which is used to generate a variety of well-characterized radiation beams for research in radiobiology, radiological physics, and radiation chemistry. It is part of the Center for Radiological Research (CRR) of Columbia University, and its operation is supported as a National Facility by the US Department of Energy (DOE). As such, RARAF is available to all potential users on an equal basis, and scientists outside the CRR are encouraged to submit proposals for

experiments at RARAF. The operation of the Van de Graaff is supported by the DOE, but the research projects themselves must be supported separately. Experiments performed from May 1991-April 1992 are described. DOE

N92-31778# Rochester Univ., NY.

FUNCTION OF P AND M PATHWAYS IN PRIMATES Annual Report

WILLIAM MERIGAN 13 Apr. 1992 3 p

(Contract AF-AFOSR-0041-89)

(AD-A250055; AFOSR-92-0310TR) Avail: CASI HC A01/MF A01

Psychophysical threshold measures were used in combination with precisely located lesions of the sub-cortical visual pathway to examine segregation of function between P and M pathways. Scleral search coils monitored fixation locus in the tested monkeys, to insure that test stimuli were presented in visual field regions corresponding to the lesion location. Results of these studies indicated that the P pathway (or color-opponent pathway) is the major contributor to visual acuity, color vision, and luminance contrast sensitivity. On the other hand, the M pathway (or broadband pathway) appeared crucial for the visibility of low spatial frequencies (broad contours), as well as sensitivity to rapidly drifting visual stimuli.

GRA

N92-31980# Topical Testing, Inc., Salt Lake City, UT.

A BIOLOGICAL MODEL OF THE EFFECTS OF TOXIC SUBSTANCES Annual Technical Report No. 1, 1 Nov. 1990 - 31 Oct. 1991

ROBERT P. TUCKETT 29 Nov. 1991 62 p

(Contract F49620-91-C-0012)

(AD-A247138; AFOSR-92-0004TR) Avail: CASI HC A04/MF A01

Due to the basic nature of military operations, it is sometimes necessary for Air Force personnel to be exposed to toxic chemicals in their work environment, either as a protracted low-level exposure or as a high-level, acute exposure. The Draize rabbit eye test for acute irritancy has come under severe criticism by the animal rights movement and has undergone legislative restrictions. Therefore, the tissue culture test being developed is likely to commercial as well as scientific benefit. Progress by topical testing during the past year has been on a number of technical fronts including the development of data collection software and a method for delivery of microquantities of toxic chemicals to individual nerve cells in tissue culture. The neuronal cultures are now viable and reproducible, and their response to a variety of chemical stimuli has been recorded. Corneal epithelial cultures have been viable for a number of months. A number of strategies have been explored to expand the corneal epithelial culture and, thus, make it a viable commercial system. In summary, topical testing has made substantial gains in the development of a commercial assay system, and next year will focus on testing the system's response to different classes of toxic chemicals.

GRA

N92-32120# Princeton Univ., NJ.

DEVELOPMENT AND APPLICATION OF PHOTOSENSITIVE DEVICE SYSTEMS TO STUDIES OF BIOLOGICAL AND ORGANIC MATERIALS

S. M. GRUNER and G. T. REYNOLDS 15 May 1992 13 p

(Contract DE-FG02-87ER-60522)

(DE92-014728; DOE/ER-60522/6) Avail: CASI HC A03/MF A01

This report describes progress as of the third year of a 3-year DoE grant for 1/1/92 to 12/31/92. Because this is the last year of a 3-year grant cycle, this report will summarize progress over the entire 3-year period. The overall goals of the grant are to develop novel instrumentation and techniques for the performance of biological and materials research, and especially for the development of x-ray detectors suitable for use at storage ring sources. Research progress has been excellent and the overall goals, as well as most of the specific goals have been successfully met.

DOE

52

AEROSPACE MEDICINE

Includes physiological factors; biological effects of radiation; and effects of weightlessness on man and animals.

A92-50071

HYPERTROPHIC RESPONSE TO UNILATERAL CONCENTRIC ISOKINETIC RESISTANCE TRAINING

DONA J. HOUSH, TERRY J. HOUSH, GLEN O. JOHNSON, and WEI-KOM CHU (Nebraska, University, Medical Center, Lincoln and Omaha) *Journal of Applied Physiology* (ISSN 8750-7587), vol. 73, no. 1, July 1992, p. 65-70. Research supported by University of Nebraska. refs

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The effect of concentric isokinetic training on the strength and the cross-sectional area (CSA) of selected extensor and flexor muscles of the forearm and leg was determined in young human subjects asked to perform six sets of 10 repetitions each of extension and flexion of nondominant limbs, three times per week for eight weeks. Pretraining and posttraining peak torque and muscle CSA were measured using a Cybex II isokinetic dynamometer and the Cybex dynamometer together with magnetic resonance imaging scanner, respectively. Results indicated significant hypertrophy in all trained muscle groups in nondominant (but not in the contralateral dominant) limbs, as well as preferential hypertrophy of individual muscles and at specific levels. The peak torque did not increase significantly for trained leg extension or for any movement in the contralateral limbs. I.S.

A92-50072

AUGMENTED HYPOXIC VENTILATORY RESPONSE IN MEN AT ALTITUDE

MOTOO SATO, JOHN W. SEVERINGHAUS, FRANK L. POWELL, FA-DI XU, and MICHAEL J. SPELLMAN, JR. (California, University, San Francisco and La Jolla) *Journal of Applied Physiology* (ISSN 8750-7587), vol. 73, no. 1, July 1992, p. 101-107. refs

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A study was conducted to test the hypothesis that the sensitivity of peripheral chemoreceptors to hypoxia and the respiratory central response to hypoxic drive remain constant during the first week of exposures to elevated altitudes. In these experiments, isocapnic 5-min step hypoxic ventilatory response (HVR) was tested in six male subjects first at sea level, then after 1-5 days at 3810-m altitude, and, finally, over 4-7 days back at sea level. It was found that peripheral chemosensitivity, as measured by HVR, at high altitude was not remaining constant but increased with time. I.S.

A92-50074

IMMEDIATE DIAPHRAGMATIC ELECTROMYOGRAM RESPONSES TO IMPERCEPTIBLE MECHANICAL LOADS IN CONSCIOUS HUMANS

ERIK J. KOBYLARZ and J. A. DAUBENSPECK (Dartmouth College, Hanover, NH) *Journal of Applied Physiology* (ISSN 8750-7587), vol. 73, no. 1, July 1992, p. 248-259. refs

(Contract NIH-HL-29068; NIH-HL-07449)

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The effects, in humans, of flow-resistive (R) and elastic (E) loads at or below the threshold of conscious detection, applied pseudorandomly to the oral airway, on the amplitude and the neural inspiratory and expiratory timing responses of crural diaphragmatic electrical activity were investigated using an esophageal electrode to measure the electrical activity of the diaphragm. It was found that most subjects responded to both types of loading by decreasing the mean tonic diaphragmatic activity, the average level of muscle activity that exists when no phasic changes are occurring, as well as its variability. I.S.

A92-50075

HUMAN TOLERANCE TO HEAT STRAIN DURING EXERCISE - INFLUENCE OF HYDRATION

MICHAEL N. SAWKA, ANDREW J. YOUNG, WILLIAM A. LATZKA, P. D. NEUFER, MARK D. QUIGLEY, and KENT B. PANDOLF (U.S. Army, Research Institute of Environmental Medicine, Natick, MA) *Journal of Applied Physiology* (ISSN 8750-7587), vol. 73, no. 1, July 1992, p. 368-375. refs

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The effect of hypohydration on human tolerance to heat strain during exercise was investigated in 17 heat-acclimated men, using two heat stress tests: one when subjects were euhydrated and one when they were hypohydrated. It was found that hypohydration reduced the level of body temperature that could be tolerated. It was also found that aerobic fitness per se did not affect the level of heat strain that could be tolerated. It was also found that exhaustion was rarely associated with a core temperature lower than 38 C but that it always occurred before the temperature of 40 C was reached. Curves were developed for estimating exhaustion rates for a given level of physical strain. I.S.

A92-50152

DETERMINANTS OF ORIENTATION IN MICROGRAVITY

STEFAN GLASAUER and HORST MITTELSTAEDT (Max-Planck-Institut fuer Verhaltensphysiologie, Seewiesen, Federal Republic of Germany) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) *Acta Astronautica* (ISSN 0094-5765), vol. 27, July 1992, p. 1-9. refs

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During two parabolic flight campaigns, human spatial orientation in an altered gravitational environment was studied by measuring the subjective visual vertical by means of a luminous line, and by asking the subjects to give a report, with eyes closed, about their orientation to apparent vertical. The inflight data are compared with baseline data measurements of the subjective horizontal body position at normogravity (1g) and at 2g. Pertinent theoretical alternatives to modeling subjective static orientation are developed and compared to the data. A good fit to the baseline results and a satisfactory prediction of the perceived orientation in microgravity can be obtained if the otolithic output is assumed to be normalized, but that of the somatic gravity sensors is not. Author

A92-50153

OCULAR TORSION AS A TEST OF THE ASYMMETRY HYPOTHESIS OF SPACE MOTION SICKNESS

SHIRLEY G. DIAMOND and CHARLES H. MARKHAM (California, University, Los Angeles) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) *Acta Astronautica* (ISSN 0094-5765), vol. 27, July 1992, p. 11-17. refs

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This experiment is conducted to study disconjugate eye torsion induced by microgravity and 1.8 G during parabolic flight in astronaut subjects with attention given to alterations in ocular torsional movements. In this manner the study attempts to predict which subjects had space-motion sickness (SMS) prior to the experiment, and the effect of an increasing number of parabolas on ocular torsional disconjugacy is examined. A camera is used to record the eye torsion at 0 and 1.8 G, and some subjects are tipped 5 or 10 deg right or left ear down. The critical finding is that astronauts with a history of SMS have enhanced ocular torsional disconjugacy during the parabolic flight suggesting that this is a predictive test of SMS. No reduction in ocular disconjugacy is noted for the subjects with tipped head axes, and the predictive test for ocular disconjugacy requires at least 10-20 parabolas. C.C.S.

A92-50154

CLINICAL VERIFICATION OF A UNILATERAL OTOLITH TEST

J. WETZIG, K. HOFSTETTER-DEGEN, J. MAURER, and R. J. VON BAUMGARTEN (Mainz, Universitaet, Federal Republic of Germany) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June

17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 19-24. refs

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An experiment is conducted to study clinically verified vestibular defectives and a control group by means of a unilateral otolith test to confirm the vestibular loss in the defectives. The test of the unilateral otolith function is based on the eccentric rotation of a rotary chair followed by examinations of the subjects' eye settings. A necessary but insufficient test of otolithic labyrinthine inequality is found to be a difference in the slope of the left and right eye's settings with a minimum angle. The test described is shown to be of interest in determining astronaut susceptibility to space motion sickness since bilateral asymmetries in the vestibular system contribute to this condition. C.C.S.

A92-50155

UVULA-NODULUS AND GRAVITY DIRECTION - A STUDY ON VERTICAL OPTOKINETIC-OCULOMOTOR FUNCTIONS

MAKOTO IGARASHI (Nihon University, Tokyo, Japan), NORIAKI TAKEDA (Osaka University, Japan), and SAYONG CHAE (Catholic University, Seoul, Republic of Korea) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 25-30. refs

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Vertical optokinetic nystagmus and after nystagmus were studied in squirrel monkeys both in the upright and side-lateral positions, before and after uvulonodectomy. When the optokinetic stimulus was given, the slow-phase eye velocity of optokinetic nystagmus was significantly higher in the side-lateral position than that obtained in the upright position. This difference disappeared after uvulonodectomy. When the initial slow-phase eye velocity of optokinetic after-nystagmus was compared, the one obtained in the side-lateral position was significantly higher than that acquired in the upright position. This difference also disappeared after the uvulonodular ablation. The role of uvula and nodulus in relaying the information of gravity direction was confirmed. Author

A92-50156

CHANGES OF BRAIN RESPONSE INDUCED BY SIMULATED WEIGHTLESSNESS

JINHE WEI, GONGDONG YAN, and ZHIQIANG GUAN (Institute of Space Medico-Engineering, Beijing, People's Republic of China) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 31-36. refs

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The characteristics change of brain response was studied during 15 deg head-down tilt (HDT) comparing with 45 deg head-up tilt (HUT). The brain responses evaluated included the EEG power spectra change at rest and during mental arithmetic, and the event-related potentials (ERPs) of somatosensory, selective attention and mental arithmetic activities. Brain-function inhibition shows that the significant increment of '40 Hz' activity during HUT arithmetic almost disappeared during HDT arithmetic and that the positive-potential effect induced by HDT presented in all kinds of ERPs measured, but the slow negative wave reflecting mental arithmetic and memory process was elongated. These data suggest that the brain function is affected profoundly by the simulated weightlessness, therefore, the brain function change during space flight should be studied systematically. Author

A92-50157

BEAT-BY-BEAT ANALYSIS OF CARDIAC OUTPUT AND BLOOD PRESSURE RESPONSES TO SHORT-TERM BAROSTIMULATION IN DIFFERENT BODY POSITIONS

WULF HILDEBRANDT, HARALD SCHUETZE, and J. STEGEMANN (Deutsche Sporthochschule, Cologne, Federal Republic of Germany) (Living and working in space; IAA Man in Space

Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 37-40. refs

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Rapid quantification of the human baroreflex control of heart rate was achieved on a beat-by-beat basis using a neck-chamber with quick ECG-triggered pressure changes. The present study uses this technique to compare cardiac output as well as blood pressure changes in supine and upright position to investigate feedback effects and to confirm postural reflex modifications not revealed by RR-interval changes. A suction profile starting at +40 mmHg and running 7 steps of pressure decrease down at -65 mmHg was examined in 0 deg and 90 deg tilting position while beat-by-beat recordings were done of heart rate, stroke volume (impedance-cardiography) and blood pressure. The percent heart-rate decrease failed to be significantly different between positions. A suction-induced stroke volume increase led to a cardiac output almost maintained when supine and significantly increased when upright. A decrease in all blood pressure values was found during suction, except for systolic values in upright position which increased. It is confirmed that different inotropy accounts for the seen gravitational effect on the cardiac output not represented by heart rate. Author

A92-50158

VOLUME LOADING OF THE HEART BY 'LEG UP' POSITION AND HEAD DOWN TILTING (-6 DEG) (HDT)

P. DIRSCHIEDL, A. GREGULL, and H. LOELLGEN (Bochum, Ruhr-Universitaet; Community Hospital, Remscheid, Federal Republic of Germany) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 41-43. refs

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Head-down tilt (HDT) and 'leg-up' tests of volume-loading of the heart are compared by means of invasive measurements with a right-heart catheter. HDT and 'leg-up' tests are found to increase pressures in the pulmonary artery, but the changes due to 'leg-up' testing are more pronounced. This and other findings provide evidence which casts doubt on the usefulness of HDT to reflect hemodynamic changes caused by weightlessness. C.C.S.

A92-50159

THE EXTERNAL RESPIRATION AND GAS EXCHANGE IN SPACE MISSIONS

V. M. BARANOV, M. A. TIKHONOV, and A. N. KOTOV (Institute of Biomedical Problems, Moscow, Russia) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 45-50. refs

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A review of data is presented on changes in the external respiration function caused by macrogravity and microgravity. Decreases in lung volume, forced vital capacity, and peak inspiratory and expiratory flows are found to vary directly with increasing flight duration. The correlation is explained with reference to the balance of elastic forces of the lungs, chest, and abdomen related to microgravity conditions. Antigravitational deconditioning of the respiratory muscles results from the space missions and can be verified in postflight testing. It is theorized that hypervolemia and pulmonary congestion lead to the development of atelectases in space during pure oxygen breathing. C.C.S.

A92-50160

CHANGES OF HORMONES REGULATING ELECTROLYTE METABOLISM AFTER SPACE FLIGHT AND HYPOKINESIA

L. MACHO, M. FICKOVA, B. LICHARDUS, R. KVETNANSKY (Slovak Academy of Sciences, Bratislava, Czechoslovakia), R. M. CARREY (Virginia, University, Charlottesville), A. GRIGOR'EV, I. A. POPOVA, R. A. TIGRANIAN, and V. B. NOSKOV (Institute of

Biomedical Problems, Moscow, Russia) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 51-54. refs

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The redistribution of body fluids and changes in the hormonal balance in plasma due to weightlessness and hypokinesia are examined in animal subjects. Hypokinesia led to a sharp early increase in plasma-renin activity and aldosterone concentration which decreased over time and returned to an almost normal level. The results show that homeostatic responses of fluid and electrolyte metabolism to space-flight conditions should be related at least in part to factors such as stress and altered diurnal cycles. C.C.S.

A92-50161

TESTING OF NEUROENDOCRINE FUNCTION IN ASTRONAUTS AS RELATED TO FLUID SHIFTS

G. SAUSENG-FELLEGER, E. M. KOENIG, H. HINGHOFFER-SZALKAY (Graz, Universitaet, Austria), D. JEZOVA, and M. VIGAS (Slovak Academy of Sciences, Institute of Experimental Endocrinology, Bratislava, Czechoslovakia) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 55-60. Research supported by BMFWF and Slovak Academy of Sciences. refs

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Optimal conditions for neuroendocrine and cardiovascular testing in astronauts are examined by testing stress reactions during LBNP of less than 50 mm Hg. There was a mild transient elevation of plasma GH concentration and a nonsignificant rise of plasma ACTH, while PRL, insulin and glucose remained unchanged. Aldosterone was decreased 5 and 10 min after beginning of LBNP, thereafter rose significantly, and displayed a further significant concentration increase 5 min post-LBNP. Exercise-induced changes of heart rate and blood pressure remained unchanged with daytime whereas plasma concentrations of epinephrine, GH and PRL in response to work load were significantly higher in the evening than in the morning. The findings demonstrate the importance of frequent sampling in case of transient physiological phenomena, and contribute to existing knowledge on circadian influences upon neuroendocrine stress responses. Author

A92-50162

BLOOD LACTATE DURING LEG EXERCISE IN MICROGRAVITY

P. ZAMPARO, C. CAPELLI, and G. ANTONUTTO (Udine, Universita, Italy) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 61-64. refs

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Venous blood lactate concentration was measured in five male subjects during cycloergometric exercise in microgravity obtained by parabolic flight maneuvers of about 25 s duration. The subject(s) exercised for at least 7 min at each intensity. Three consecutive parabolas with about 3-min intervals were performed at each workload. The day after the flight experiments, the subject underwent the same experimental protocol on the ground and the blood samples were taken at the very same time intervals as on the aircraft. Lactate concentration in flight and control did not show any appreciable difference once the values are plotted as a function of the relative exercise intensities expressed as a percent of the individual maximum O₂ uptake corrected for the moderate hypoxia prevailing inside the aircraft. Author

A92-50163

THE INFLUENCE OF DIFFERENT SPACE-RELATED PHYSIOLOGICAL VARIATIONS ON EXERCISE CAPACITY DETERMINED BY OXYGEN UPTAKE KINETICS

J. STEGEMANN (Deutsche Sporthochschule, Cologne, Federal

Republic of Germany) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 65-69. refs

(Contract DARA-FKZ-01-QV-87345)

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Oxygen uptake kinetics, following defined variations of work load changes allow to estimate the contribution of aerob and anaerob energy supply which is the base for determining work capacity. Under the aspect of long duration missions with application of adequate dosed countermeasures, a reliable estimate of the astronaut's work capacity is important to adjust the necessary inflight training. Since the kinetics of oxygen uptake originate in the working muscle group itself, while measurements are performed at the mouth, various influences within the oxygen transport system might disturb the determinations. There are not only detraining effects but also well-known other influence, such as blood- and fluid shifts induced by weightlessness. They might have an impact on the circulatory system. Some of these factors have been simulated by immersion, blood donation, and changing of the body position. Author

A92-50164

ARTIFICIAL GRAVITY IN SPACE - VESTIBULAR TOLERANCE ASSESSED BY HUMAN CENTRIFUGE SPINNING ON EARTH

G. ANTONUTTO (Udine, Universita, Italy), D. LINNARSSON, C. J. SUNDBERG (Karolinska Institutet, Stockholm, Sweden), and P. E. DI PRAMPERO (Udine, Universita, Italy) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 71-73. Research supported by MURST. refs

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The use of coupled counterrotating bicycles in the space module to counteract musculoskeletal and cardiovascular deconditioning is assessed from the point of view of acute motion sickness as a side effect. A centrifuge is used to simulate the rotating environment, and measurements of motion sickness are conducted. The subjects do not show symptoms of acute motion sickness demonstrating the feasibility of using the Twin Bikes System in space. C.C.S.

A92-50165

MICROGRAVITY, CALCIUM AND BONE METABOLISM - A NEW PERSPECTIVE

MICHAEL F. HOLICK (Boston University; Boston City Hospital, MA) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 75-81. refs

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The prevention and amelioration of microgravity-induced bone loss is addressed with specific references to countermeasures and their verification by monitoring bone density. Attention is given to the consequences of microgravity-related bone loss for astronauts, and the results of bed-rest studies are examined and shown to mimic the bone loss and osteoporosis resulting from space travel. Previous results are examined that indicate that microgravity does not alter the bone-mineralization process; this suggests that bone cells become adapted to gravity. A scenario is developed for bone and calcium metabolism in the microgravity environment. Unloading G-forces leads to a depression in bone formation and accelerated bone mineralization. These processes lead to changes in levels of parathyroid secretions and finally inefficient intestinal calcium transport. C.C.S.

A92-50166

NON-INVASIVE DENSITOMETRY

PAUL LIPS (Free University Hospital, Amsterdam, Netherlands) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991,

Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 83-87. refs

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An overview is given of methods for the high-precision measurement of bone density in several regions of the skeleton. The methodology of bone-density study is set forth, and descriptions are given of single- and dual-photon absorptiometry, dual-energy X-ray absorptiometry, Compton scattering, neutron activation, and quantitative computed tomography. The advantages of the techniques are discussed in terms of the experimental environment, test type, and the region of the skeleton under scrutiny. Under the conditions of microgravity, dual-energy X-ray absorptiometry and quantitative computed tomography are shown to be the most effective techniques. Ultrasound techniques can be used to study bone mineral density of the spine and femur, and the lack of radiation makes the technique repeatable and benign. C.C.S.

A92-50167* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

COUNTERMEASURES AGAINST SPACE FLIGHT RELATED BONE LOSS

ADRIAN LEBLANC and VICTOR SCHNEIDER (NASA, Johnson Space Center, Houston, TX) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 89-92. refs

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A general review is presented of data on bone loss with references to countermeasures for use during spaceflight and bedrest. The two primary countermeasures against skeletal atrophy are skeletal loading such as centrifugation and exercise and/or the administration of drugs designed to alter the rate of bone remodeling. Bone loss is argued to be unavoidable in long-duration spaceflight in spite of countermeasures utilized, but a combination of exercise, biochemical treatments, and post-flight therapy is considered the optimal solution. C.C.S.

A92-50168

CARDIAC FACTORS IN ORTHOSTATIC HYPOTENSION

H. LOELLGEN, P. DIRSCHIEDL (Bochum, Ruhr-Universitaet; Community Hospital, Remscheid, Federal Republic of Germany), K. KOPPENHAGEN (Berlin, Free University, Federal Republic of Germany), and K. E. KLEIN (DLR, Institut fuer Flugmedizin, Cologne, Federal Republic of Germany) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 93-95. refs

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The relationships between volume displacement during orthostatic stress and parameters of cardiac function are reviewed to determine whether LBNP can be used to evaluate orthostatic tolerance. Cardiac factors, the pressure-volume curve, and changes in regulatory mechanisms are shown to be affected significantly by LBNP. Cardiac function during LBNP can be measured by preload and afterload heart rates and countered by drug-induced alpha-receptor activation. C.C.S.

A92-50169

ORTHOSTATIC HYPOTENSION OF PROLONGED WEIGHTLESSNESS - CLINICAL MODELS

DAVID ROBERTSON, ITALO BIAGGIONI, ROGELIO MOSQUEDA-GARCIA, and ROSE M. ROBERTSON (Vanderbilt University, Nashville, TN) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 97-101. refs

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The disorders that produce chronic orthostatic hypotension are examined for use as clinical models of orthostatic intolerance

induced by microgravity conditions. The disorders are discussed generally with specific attention given to the Bradbury-Eggleston syndrome, the Shy-Drager syndrome, dopamine-beta-hydroxylase deficiency, and hyperadrenergic orthostatic hypotension. The pathophysiology of each syndrome is reviewed as well as the nosology of related chronic orthostatic hypotensive mechanisms related. The Bradbury-Eggleston syndrome is found to be a good model of severe orthostatic intolerance due to the high sensitivity of afflicted patients. The Shy-Drager syndrome presents some drawbacks as compared to other diseases, and the study of subjects with dopamine-beta-hydroxylase deficiencies can contribute to the study of the autonomic nervous system with respect to cardiovascular control. C.C.S.

A92-50170

LOWER BODY NEGATIVE PRESSURE AS A COUNTERMEASURE AGAINST ORTHOSTATIC INTOLERANCE FOR LONG-TERM SPACEFLIGHT

A. GUELL, A. CORNAC, M. M. FAURAT, G. GAUQUELIN, A. PAVY-LE TRAON, and CL. GNARIB (MEDES, Toulouse, France) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 103-107. Research supported by CNES, Centre Hospitalier Regional de Toulouse, and Fondation pour la Recherche Medicale. refs

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The effects of periodical LBNP sessions on cardiovascular adaptation syndrome (CAS) and on orthostatic hypotension are assessed for a bedrest experiment with references to countermeasures. Two 40-day bedrest experiments are conducted in which the human subjects perform 3-6 LBNP sessions daily. Two orthostatic investigations are conducted each day, and significant increases in heart rate are noted in the postbedrest tilt test as compared to the ambulatory period of the test. The pathogenetic mechanisms observed are similar to those related to the return phase of space transportation. The mechanisms include: decreased plasma volume, cardiovascular reflexes against orthostatism with decreased efficiency, and increased venous compliance in the lower limbs. The experiments support the beneficial aspects of LBNP as a prophylaxis to be applied to the treatment of humans during and following space flight. C.C.S.

A92-50171

HORMONAL CONTROL OF BODY FLUID METABOLISM

R. GERZER and C. DRUMMER (Muenchen, Universitaet, Medizinische Klinik, Munich, Federal Republic of Germany) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 109-114. refs

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The effects of microgravity on body-fluid metabolism are examined to outline the requirements of experimental research into human adaptation to weightlessness. Attention is given to the mechanisms regulating body-fluid metabolism including fluid uptake/excretion, metabolism systems, and the influence of hormones on fluid metabolism. The factors are enumerated which influence hormones participating in the regulation of metabolism, and cellular effects are discussed as they relate to the hormonal contribution. The importance of the hormones in regulating fluid metabolism is established, but the knowledge of these processes is shown to be insufficient. Some suggestions are given regarding directions of research to study the effects of microgravity on hormonal processes that regulate human metabolism. C.C.S.

A92-50172

ORTHOSTATIC INTOLERANCE IN 6 DEGREES HEAD-DOWN TILT AND LOWER BODY NEGATIVE PRESSURE LOADING

KAZUYOSHI YAJIMA, AKIRA MIYAMOTO, MASAO ITO, TAKAICHI MANO (Nihon University, Tokyo, Japan), and KIYOSHI NAKAYAMA (Sophia University, Tokyo, Japan) (Living and working in space;

IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 115-121. Research supported by MOESC. refs
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An experimental program is undertaken to study orthostatic intolerance by means of the 6-deg HDT preceded and followed by 70-deg head-up tilt (HUT) and by means of lower-body negative pressure (LBNP). LBNP is employed to evaluate the validity of heart-rate controllability index (HRCI) which is the ratio of the relative increase of heart rate to the initial increase of leg-blood volume. Bed rest is followed by HUT and subsequently by LBNP and HUT, and the same procedure is repeated for higher values of LBNP. No orthostatic intolerance is noted at -20 mmHg LBNP, and some subjects show presyncope during the -40 mmHg LBNP. HRCI percent change is found to be minimal for the cases of the brain anemia type of orthostatic intolerance, whereas the vagotonia type of orthostatic intolerance corresponds to greater changes in HRCI percentages. C.C.S.

A92-50173* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL.
EFFECTS OF EXERCISE AND INACTIVITY ON INTRAVASCULAR VOLUME AND CARDIOVASCULAR CONTROL MECHANISMS

VICTOR A. CONVERTINO (NASA, Kennedy Space Center, Cocoa Beach, FL) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 123-129. refs
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Using models of exercise, inactivity and confinement, integrated and redundant roles for vascular volume and cardiovascular baroreflexes are demonstrated as probable underlying mechanisms that contribute independently to the development of orthostatic hypotension following spaceflight. These data suggest that loading of arterial baroreceptors may be necessary to maintain baroreflex functions. Author

A92-50188* National Aeronautics and Space Administration, Washington, DC.
POLYMER DEGRADATION AND ULTRAFINE PARTICLES - POTENTIAL INHALATION HAZARDS FOR ASTRONAUTS

J. FERIN and G. OBERDOERSTER (Rochester, University, NY) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 257-259. refs
(Contract NAGW-2356; NIH-ES-01247; NIH-ES-04872)
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To test the hypothesis that exposure to ultrafine particles results in an increased interstitialization of the particles which is accompanied by an acute pathological inflammation, rats were exposed to titanium dioxide (TiO₂) particles by intratracheal instillation and by inhalation. Both acute intratracheal instillation and subchronic inhalation studies on rats show that ultrafine TiO₂ particles access the pulmonary interstitium to a larger extent than fine particles and that they elicit an inflammatory response as indicated by PMN increase in lavaged cells. The release of ultrafine particles into the air of an enclosed environment from a thermodegradation event or from other sources is a potential hazard for astronauts. Knowing the mechanisms of action is a prerequisite for technical or medical countermeasures. Author

A92-50283
MAXIMUM INTRA-THORACIC PRESSURE WITH ANTI-G STRAINING MANEUVERS AND POSITIVE PRESSURE BREATHING DURING +GZ

F. BUICK, J. HARTLEY, and M. PECARIC (Defence and Civil Institute of Environmental Medicine, North York, Canada) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 63,

no. 8, Aug. 1992, p. 670-677. refs
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Positive pressure breathing during +Gz (PBG) and anti-G straining maneuvers (AGSM) each improve +Gz tolerance by increasing blood pressure through increases in intra-thoracic pressure, but the maximal intra-thoracic pressure from their combined effect is not known. Six subjects performed the following: (1) maximal AGSM at +1 Gz; (2) assisted PBG (constant 60 mm Hg) at +Gz; (3) submaximal AGSM at +Gz; (4) maximal AGSM at +Gz; and (5) combined PBG and maximal AGSM at +Gz. They wore TLSS mask/helmet ensemble, CSU-15/P G-suit, and TLSS-style jerkin. Intra-thoracic pressure was measured with a catheter-tip pressure transducer in the esophagus (Pes). The change in gastric pressure was also measured (deltaPga). For both Pes and deltaPga, there were no significant differences among experimental conditions (1), (4) and (5), as above. Group mean Pes and deltaPga in these three conditions were 139 and 197 mm Hg, respectively. Author

A92-50284* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, FL.

ADAPTATIONS TO UNILATERAL LOWER LIMB SUSPENSION IN HUMANS

GARY A. DUDLEY, MARC R. DUVOISIN (NASA, Kennedy Space Center, Cocoa Beach, FL), GREGORY R. ADAMS (Bionetics Corp., Biomedical and Environmental Laboratories; NASA, Kennedy Space Center, Cocoa Beach, FL), RONALD A. MEYER (Michigan State University, East Lansing), ANNE H. BELEW (Holmes Regional Medical Center, Melbourne, FL), and PAUL BUCHANAN (NASA, Kennedy Space Center, Cocoa Beach, FL) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 63, no. 8, Aug. 1992, p. 678-683. refs
(Contract NAS10-10285; NAS10-11624)
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The effect of unilateral lower limb suspension (ULLS) on neuromuscular function in humans is analyzed. All ambulatory activity on crutches was performed by eight subjects for 6 weeks who wear a shoe with a 10 cm sole on the right foot to unweight the left lower limb. Results show that average muscle cross sectional area (CSA) of the left knee extensor (KE) decreased 16 percent whereas the KE of the nonsuspended right limb showed no changes. Maximal integrated electromyography of vastus lateralis and overall mean power frequency of gastrocnemius medialis and soleus for submaximal isometric actions were both decreased post-ULLS. It is concluded that six weeks of ULLS induces adaptations in the neuromuscular system of humans which are comparable to those induced by bed rest and spaceflight. O.G.

A92-50286
INFLUENCE OF SELF-INDUCED HYPNOSIS ON THERMAL RESPONSES DURING IMMERSION IN 25 C WATER

KAREN D. MITTLEMAN (Rutgers University, New Brunswick, NJ), THOMAS J. DOUBT, and MEL A. GRAVITZ (U.S. Navy, Naval Medical Research Institute, Bethesda, MD) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 63, no. 8, Aug. 1992, p. 689-695. refs
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The efficacy of self-induced hypnotic suggestion to alter perceptual, physical, and thermogenic responses during head-out immersion in 25 C water was evaluated in 12 males. It is hypothesized that the hypnosis-induced alterations would enable the subjects to work in cool water for a longer period of time with greater thermal comfort and a reduced perceptual effort. A control immersion was performed prior to two 1-h hypnotic training sessions. A second hypnotic immersion was done within 24 h after training. No differences were found in rates of heat production, heat loss, mean skin temperature, or rectal temperature between control and hypnotic immersion. Results indicate that brief hypnotic training did not enhance the thermogenic response to cool water immersion. O.G.

A92-50287**EFFECT OF HIGH TERRESTRIAL ALTITUDE AND SUPPLEMENTAL OXYGEN ON HUMAN PERFORMANCE AND MOOD**

JOHN S. CROWLEY (U.S. Army, Aeromedical Research Laboratory, Fort Rucker, AL), NANCY WESENSTEN, GARY KAMIMORI (U.S. Army, Walter Reed Institute of Research, Washington, DC), JAMES DEVINE, EUGENE IWANYK (U.S. Army, Institute of Environmental Medicine, Natick, MA), and TOM BALKIN (U.S. Army, Walter Reed Institute of Research, Washington, DC) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 63, no. 8, Aug. 1992, p. 696-701. refs

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Sustained exposure to high terrestrial altitudes is associated with cognitive decrement, mood changes, and acute mountain sickness (AMS). Such impairment in aviators could be a safety hazard. Thirteen male soldiers, ages 19-24, ascended in 10 min from sea level to 4300 m (simulated), and remained there 2.5 d. Four times per day, subjects completed a test battery consisting of nine cognitive tests, a mood scale, and an AMS questionnaire. During one test session per day, subjects breathed 35 percent oxygen instead of ambient air. Analysis revealed transient deficits on altitude day 1 for three cognitive tasks. Most tasks displayed a persistent training effect. Sick subjects' moods were more negative and their performance improvement less. On altitude day one, oxygen administration improved performance on two cognitive tests and one mood subscale. Following rapid ascent to 4300 m, performance is most affected during the first eight h. Individuals affected by AMS tend to improve more slowly in performance and have more negative moods than those who feel well.

Author

A92-50289**THE EFFECT OF CAPTOPRIL ON +GZ TOLERANCE OF NORMOTENSIVES**

M. A. PAUL and G. W. GRAY (Defence and Civil Institute of Environmental Medicine, North York, Canada) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 63, no. 8, Aug. 1992, p. 706-708. refs

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A specific aeromedical question of the effect of captopril on tolerance to +Gz stress is investigated using a counterbalanced double blind crossover protocol to administer 25 mg of captopril or placebo twice daily in identical capsules to seven fit, normotensive individuals. It is recommended that captopril should be used with caution to treat hypertensive fighter aircrew taking into account the relatively low dosage and the significant compromise of Gz-tolerance on both relaxed and straining gradual onset runs. It is noted, however, that pending the results of further research to assess the performance consequences of captopril on parameters of reaction time, vigilance, and logical reasoning, captopril may prove to be acceptable for use in other aircrew.

O.G.

A92-50290**EFFECT OF GZ FORCES AND HEAD MOVEMENTS ON CERVICAL ERECTOR SPINAE MUSCLE STRAIN**

OLAVI HAMALAINEN (Air Force Academy, Kauhava, Finland) and HEIKKI VANHARANTA (Oulu University Central Hospital, Finland) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 63, no. 8, Aug. 1992, p. 709-716. Research supported by Finnish Defence Forces and Supporting Foundation of the Finnish Air Force. refs

Copyright

A portable surface-integrated EMG (IEMG) device was used to investigate the strain caused by low and high Gz forces and head movements on the cervical erector spinae muscles during flight missions. The obtained IEMG activities were normalized by comparing them with activities representing maximal voluntary contraction (MVC) of the cervical erector spinae muscles in each subject. The muscular strain increased with increasing Gz forces and head movements. Under +7.0 Gz the mean muscular strain was 5.9-fold compared with +1.0 Gz and was 37.9 percent of

the MVC. In some individuals, the muscular tolerance was ipsilaterally reached already under +4.0 Gz with concomitant movements and twisted positions of the head. Pilots are susceptible to acute neck injury when the protection afforded by their neck muscles is insufficient.

Author

A92-50292**INJURIES ASSOCIATED WITH THE USE OF EJECTION SEATS IN FINNISH PILOTS**

TUOMO VISURI and JUHANI AHO (Central Military Hospital, Helsinki, Finland) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 63, no. 8, Aug. 1992, p. 727-730. refs

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All ejection seats events for the time period of 1958-1991 in the Finnish Air Force are analyzed focusing on the injuries sustained by the pilots. The aircraft types included BA Hawk, Mig 21-F-13, Mig-21-Bis, Gnat Folland, Vampire Trainer, and MU-3. All major injuries were associated with Soviet aircraft. One BA-Hawk pilot died because of a direct impact against a tree after a low-altitude ejection. Four Hawk pilots were saved during landing phase by a tandem ejection, receiving only minor injuries.

O.G.

A92-52386**ISSUES IN HUMAN GRAVITATIONAL PHYSIOLOGY - A MEDICAL PERSPECTIVE ON GRAVITY AND THE CELL**

HARRY C. HOLLOWAY (Uniformed Services University of the Health Sciences, Bethesda, MD) ASGSB Bulletin (ISSN 0898-4697), vol. 4, no. 2, July 1991, p. 19-21. refs

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An applied physiology evaluation is presented of current understanding of the long-term effects of microgravity, with emphasis on the general need for multidisciplinary approaches to problems in this field and the need to identify which of the pathologies observed in space are not merely analogous, but truly homologous, to those encountered in terrestrial medicine. A major effort is called for in the determination of space-observed physiologic abnormalities, which may be generated by the combined action of several possible variables. Attention must be given to spaceflight parameters that may lead to immune system impairment in human subjects.

O.C.

A92-52395**CHANGES OBSERVED IN LYMPHOCYTE BEHAVIOR DURING GRAVITATIONAL UNLOADING**

AUGUSTO COGOLI (Zuerich, Eidgenoessische Technische Hochschule, Zurich, Switzerland) ASGSB Bulletin (ISSN 0898-4697), vol. 4, no. 2, July 1991, p. 107-115. Research supported by Eidgenoessische Technische Hochschule Zuerich. refs

(Contract SNSF-3,338-0,86)

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The effect of microgravity has been extensively studied on human lymphocytes in several space missions. A clear distinction must be made between two kinds of experiments: (1) with cells purified from the peripheral blood of test subjects before flight and then exposed inflight to mitogens and other activators (these are called *in vitro* experiments), and (2) with lymphocytes from crewmembers of space missions exposed to mitogens prior to and after flight (*ex vivo* experiments). The first approach can be considered as basic research in cell biology in space; the second contributes to identifying the effects of the stress of spaceflight on the immune response of astronauts. The results from *in vitro* experiments have clearly shown that lymphocyte activation is nearly totally depressed in microgravity. This activation depression is confirmed by investigations on earth in the fast rotating clinostat. Conversely, activation is increased when lymphocytes are cultured at 10 g in a centrifuge. In microgravity cell adhesion may be reduced, thus partly accounting for the decreased cell activation. The results of the experiments conducted at 10 g are due to a simultaneous activation of T- and B-lymphocytes by concanavalin A. The reduced activation observed in lymphocytes from crewmembers of space missions can be ascribed to both the physical and psychological stress of spaceflight.

Author

A92-53002**HUMAN ADAPTATION AND ITS LIMITATIONS IN A HOT ENVIRONMENT**

JUNICHI SUGENOYA (Aichi Medical University, Japan) Japanese Journal of Aerospace and Environmental Medicine (ISSN 0387-0723), vol. 29, no. 1, March 1992, p. 19-21. In Japanese. refs

Copyright

The human adaptation to a hot environment, and changes in central circulation and body fluids are examined. Short-term and long-term effects are examined and compared. Y.P.Q.

N92-30319# Dalhousie Univ., Halifax (Nova Scotia). Dept. of Psychology.

NEUROPHYSIOLOGICAL ANALYSIS OF CIRCADIAN RHYTHM ENTRAINMENT Annual Report, 1 Jan. - 31 Dec. 1991

BENJAMIN RUSAK 31 Dec. 1991 6 p

(Contract AF-AFOSR-0104-90)

(AD-A248466; AFOSR-92-0187TR) Avail: CASI HC A02/MF A01

During the 1991 contract period we published papers on the effects of clorgyline treatment on photic responses of neurons in the circadian entrainment pathway, and on the effects of NMDA neurotransmitter antagonists on photic activation of gene expression in the entrainment pathway. We have completed further studies on regulation of messenger RNA levels for several immediate-early genes (IEG) in suprachiasmatic nucleus (SCN) cells in response to light pulses and on the effects of a non-NMDA antagonist on IEG expression in the SCN; the related manuscripts were accepted for publication. Further studies were completed and submitted for publication or are currently in preparation. These include studies on the following: the effects of different temporal patterns of light exposure on SCN cells and on rhythm phase-shifting; antagonism by serotonin of light effects on cells in the circadian system; the effects of bombesin-like peptides on SCN neuronal activity; the effects of several excitatory amino acids on SCN cells in vitro; the regulation of the melatonin sensitivity rhythm of SCN cells; and the roles of nerve growth factor and muscarinic receptor antagonists in modifying circadian responses to cholinergic agents. The results of these studies were either submitted for publication or are in preparation. GRA

N92-30328# Army Research Inst. of Environmental Medicine, Natick, MA.

THE USE OF TYMPANOMETRY TO DETECT AEROTITIS**MEDIA IN HYPOBARIC CHAMBER OPERATIONS Final Report**

V. A. FORTE, JR., J. A. DEVINE, P. B. ROCK, and A. CYMERMAN 31 Jan. 1992 31 p

(AD-A248963) Avail: CASI HC A03/MF A01

Diagnosis and quantification of aerotitis media were performed using a modified commercially-available tympanometer under hypobaric conditions. Subjects were 22 males and 9 females, 22-43 years of age who were tested in each ear with the tympanometer prior to and after exposure, sequentially at the barometric pressure plateaus of 706, 656, 609, 586, 564, and 522 mm Hg, and following an induced ear block during a 1-min descent from 522 to 586 mm Hg. Each Subject was examined once either alone or in pairs during a 90-min exposure. Aerotitis media was detected using tympanometry at simulated altitude as indicated by the difference between measurements made prior to, and during, induced ear blocks as well as following relief of the pressure differential with a Valsalva maneuver. There were no significant differences between pre-and post-hypobaria. Our study suggests that tympanometry can be a valuable tool in managing aerotitis media in the aeromedical environment. GRA

N92-30376# Texas A&M Univ., College Station. Dept. of Biology.

MELATONIN, THE PINEAL GLAND AND CIRCADIAN RHYTHMS Annual Report, 1 Mar. 1991 - 30 Apr. 1992

VINCENT M. CASSONE 30 Apr. 1992 4 p

(Contract AF-AFOSR-0244-90)

(AD-A250640; AFOSR-92-0413TR) Avail: CASI HC A01/MF A01

This research tests the null hypothesis that the restricted phase

of melatonin sensitivity in rats is at least partially due to a coincidence of the time at which exogenous melatonin is administered and the time at which endogenous melatonin begins to rise. Results suggest that the cerebral moiety responding to melatonin (presumably the SCN) responds to it quantally within a very restricted phase, and that this effect is independent of the pineal gland. Pinelectomy had no effect on the binding pattern, affinity or capacity within either the SCN or the pars tuberalis.

GRA

N92-30523# Southeastern Center for Electrical Engineering Education, Inc., Saint Cloud, FL.

OPTIMAL ECG ELECTRODE SITES AND CRITERIA FOR DETECTION OF ASYMPTOMATIC CORONARY ARTERY DISEASE, UPDATE 1990. MULTILEAD ECG CHANGES AT REST, WITH EXERCISE, AND WITH CORONARY ANGIOPLASTY Final Report, 1 Jun. 1989 - 15 Dec. 1990

RONALD H. SELVESTER, JOSEPH C. SOLOMON, KESSAG BARON, HELGE A. SAETRE, and MYRVIN H. ELLESTAD Feb. 1992 62 p Prepared in cooperation with University of Southern California, Downey and Memorial Heart Inst., Long Beach, CA (Contract F33615-87-D-0609)

(AD-A248613; AL-TR-1991-0029) Avail: CASI HC A04/MF A01

This report presents recent findings from the Selvester-Solomon forward model of the electrophysiology of the human heart simulating infarct and ischemia. This led to a study of a 16-lead ECG at the time of coronary angioplasty. Both the simulations and the angioplasty study (reported in detail in this report) provide evidence that routine screening of apparently healthy aircrews with Hi-Fi rest and exercise 30 lead ECGs will significantly improve the detection of asymptomatic coronary disease. Three ECG recording systems with signal processing of 30 simultaneous leads (30SL) have been developed. These systems record and store on disk up to 2 hr of continuous 3 lead rhythm strips and 10 s epochs of 30SL median beats sampled at 1 ms. Design documents, flow diagrams, schematics, and safety documentation for the 3 ECG mapping systems, and for 3 electrode locator systems designed and fabricated on this contract, are provided. The design of the study at Long Beach Memorial and Armstrong Laboratory is also presented for the follow-on 1 year's contract using 30SL data during exercise (and angioplasty) to define the optimal number of leads and criteria in them for the optimal detection of asymptomatic coronary disease in aircrew persons. GRA

N92-30603# Naval Health Research Center, San Diego, CA.

FEASIBILITY OF A WALK TEST TO ASSESS THE CARDIORESPIRATORY FITNESS OF NAVAL PERSONNEL Final Report

JOHN PLEAS and LINDA T. STEVENS Aug. 1991 17 p

(AD-A250650; NHRC-91-28) Avail: CASI HC A03/MF A01

The feasibility of using a cost-efficient walk test to assess cardiorespiratory fitness among Navy personnel was the major focus of this paper. Studies assessing the ability of pulse rate and 1- and 2-mile timed distance walks to predict maximum oxygen consumption (VO₂ max) were reviewed and prediction equations generated from multiple regression analyses were examined. Research findings indicate that a walk test provides a reasonable reliable estimate of VO₂ max in a field setting. The strongest evidence in this regard was provided by Kline and colleagues at the University of Massachusetts who developed an equation to estimate VO₂ max based on five factors: time to complete a 1-mile walk, average heart rate for the fourth quarter of the mile walk, age, weight and sex. The correlations between measured VO₂ max and estimated VO₂ max was $r = .93$ ($SE = .325$ 1/min) when oxygen consumption was not adjusted for body weight and $r = .88$ ($SE = 5.0$ 1/kg min) when oxygen consumption was adjusted for body weight. Correlations ranging from .74 to .93 were obtained in diverse cross-validation groups. Based on a review of the fitness walking literature, it was concluded that a 1-mile walk test is a valid indicator of cardiorespiratory fitness in the general population. GRA

N92-30605# Aerospace Medical Research Labs., Brooks AFB, TX.

EFFECTS OF PYRIDOSTIGMINE BROMIDE ON A-10 PILOTS DURING EXECUTION OF A SIMULATED MISSION; PERFORMANCE Final Report, Jul. 1984 - Aug. 1991

REBECCA B. BROOKS, DAVID C. HUBBARD, SAMUEL G. SCHIFLETT, ROBERT R. WOODRUFF, and ARTHUR E. HARRIMAN May 1992 43 p
(AD-A252309; AL-TR-1992-0005) Avail: CASI HC A03/MF A01

This report documents the performance results of a study that was conducted to determine the effects of pyridostigmine bromide (PYB) (30 mg 3x/day) on pilot performance. Data was collected in an A-10 flight simulator with an Advanced Visual Technology System (AVTS). The subjects were 24 A-10 pilots who were trained on the following simulated tasks over three 55-min sessions: takeoff, patterns, emergency procedure, and landing; air-to-air refueling; conventional low-angle strafing; and low-level ingress to a simulated target and threat area (RED FLAG). Next, during two test sessions, 48 h apart, the pilots were tested using a double-blind procedure on the same tasks in a PYB condition and in a placebo condition. In the two test sessions, 12 of the pilots wore chemical defense ensembles (CDE) and the other 12 wore standard flight gear (SFG). The results indicate that there are no operationally significant effects of pyridostigmine bromide that would preclude an A-10 pilot from accomplishing a tactical mission, including air-to-ground attack, under a chemical warfare threat. GRA

N92-30644# Naval Health Research Center, San Diego, CA.
EXERCISE BEHAVIOR AMONG NAVY RUNNERS AND NON-RUNNERS Final Report

JOHN PLEAS Dec. 1991 31 p
(AD-A250651; NHRC-91-43) Avail: CASI HC A03/MF A01

It is generally believed that running is the royal road to fitness. While this may be true for cardiorespiratory fitness, data are unavailable on whether this statement applies to overall fitness. The present study examined physical fitness classifications and the self-reported exercise patterns, weekly kilocalorie expenditure, and social support scores of Navy personnel who either ran, walked, did both or did neither for exercise. Results indicated that runners not only fell into higher fitness categories and expended more kilocalories each week in exercise, but reported higher frequency and duration of exercise, longer involvement in all types of exercise, and greater social support. It is possible that the runners represented a select group of highly motivated fitness-oriented individuals who ascribed to the physical concepts promulgated by the Navy. However, the number of individuals failing the physical readiness test and receiving satisfactory fitness classification remains a physical readiness concern. Consequently, research on short-term and long-term exercise adherence strategies and the role of specific exercise support and general support in facilitating exercise behavior is warranted. GRA

N92-30719# Texas Univ., Galveston. Medical Branch.
SECRETORY MECHANISMS IN OPIOCORTIN CELLS DURING COLD STRESS Final Report, 1 Aug. 1987 - 30 Sep. 1991

GWEN V. CHILDS 15 Jun. 1992 15 p
(Contract N00014-88-K-0016; NR PROJ. RR0-4108)
(AD-A252317) Avail: CASI HC A03/MF A01

The goals of the study were to characterize the sequence of events involved in the hypothalamic-pituitary responses to cold stress. In the hypothalamus, studies focused on Arginine vasopressin neurons and changes in expression of mRNA following cold and novel environment exposure. In the pituitary, studies focused on AVP and CRH target cells, including corticotropes, thyrotropes, and intermediate lobe cells. Changes in size, granulation, expression of mRNA, and binding sites for AVP and CRH were detected. In vitro studies of second messenger effects on CRH and AVP binding provided more clues about mechanisms of action. Finally, a new cell type that changed to a multihormonal corticothyrotrope under the influence of AVP was described. It could provide an efficient means of stimulating both the thyroid and the adrenal. Studies implicating locally produced epidermal

growth factor (EGF) as another modulatory agent in the stress response were also done because EGF stimulates corticotropes. Cells producing EGF increased expression of EGF mRNA after exposure to cold. In summary, these studies identified four critical hormones that interact with each other in the control of pituitary responses to cold. These included: AVP, CRH, thyrotropin releasing hormone (TRH) and epidermal growth factor. GRA

N92-30745# Cleveland Metropolitan General Hospital, OH. Div. of Cardiology.

TOLERANCE OF BETA BLOCKED HYPERTENSIVES DURING ORTHOSTATIC AND ALTITUDE STRESSES

STEVEN M. TEAGUE and JERRY R. HORDINSKY Apr. 1992 36 p
(Contract DTFA02-86-85098)
(AD-A249904; DOT/FAA/AM-92/19) Avail: CASI HC A03/MF A01

To evaluate the effects of orthostatic, attitude, and pharmacologic stresses upon civil aviation-specific performance, a double-blind, randomized, crossover trial of atenolol, 100mg, was designed and executed. Hypertensive males and females qualifying for the FAA class 3 certificate with mean age of 34 were studied during simulated altitude exposure to 12,500 ft, orthostatic stress, and moderate exercise. Seated lower body negative pressure to -40 mmHg supplied orthostatic stress simulating +2G vertical acceleration. A total of 160 lower body negative pressure tests were performed, 80 at ground and 80 at altitude. Beta-blockade caused a modest impairment in orthostatic tolerance. Five of the 80 lower body negative pressure runs at ground level were marked by intolerance, and all of those responses were in beta-blocked subjects. Of the 80 attitude runs, 30 were terminated for intolerance, of which 18 included beta-blockade. These findings had a Chi-square significance value of P less than .05. The effect of altitude was significant at P less than .01. In a modest exercise protocol (100 watts for 3 minutes) meant to be no more stressful than the exertional requirements of piloting an aircraft during adverse conditions, neither beta-blockade or altitude appeared to limit performance. Quantitative performance on a computerized cognitive battery clearly demonstrated impaired performance during lower body negative pressure stress at altitude. The degree of impairment was significant compared to a learning curve response at the P less than .001 level. The degree of impairment was similar for placebo treated and beta-blocked subjects. GRA

N92-30987* National Aeronautics and Space Administration, Washington, DC.

AEROSPACE MEDICINE AND BIOLOGY: A CONTINUING BIBLIOGRAPHY WITH INDEXES (SUPPLEMENT 363)

Jun. 1992 69 p
(NASA-SP-7011(363); NAS 1.21:7011(363)) Avail: CASI HC A04/MF A01

This bibliography lists 164 reports, articles and other documents introduced into the NASA Scientific and Technical Information System during Jan. 1992. Subject coverage includes aerospace medicine and physiology, life support systems and man/system technology, protective clothing, exobiology and extraterrestrial life, planetary biology, and flight crew behavior and performance.

Author

N92-31011# Pacific Northwest Lab., Richland, WA.
THE REVISED INTERNATIONAL COMMISSION ON RADIOLOGICAL PROTECTION (ICRP) DOSIMETRIC MODEL FOR THE HUMAN RESPIRATORY TRACT

W. J. BAIR May 1992 5 p Presented at the 8th International Radiation Protection Association World Congress, Vancouver, Ontario, 10-22 May 1992
(Contract DE-AC06-76RL-01830)
(DE92-015092; PNL-SA-20194; CONF-920501-16) Avail: CASI HC A01/MF A01

A task group has revised the dosimetric model of the respiratory tract used to calculate annual limits on intake of radionuclides. The revised model can be used to project respiratory tract doses for workers and members of the public from airborne radionuclides

and to assess past exposures. Doses calculated for specific extrathoracic and thoracic tissues can be adjusted to account for differences in radiosensitivity and summed to yield two values of dose for the respiratory tract that are applicable to the ICRP tissue weighted dosimetry system. DOE

N92-31127# Space and Naval Warfare Systems Command, Washington, DC.

EFFECTS OF MICROWAVE RADIATION ON HUMANS: MONKEYS EXPOSED TO 1.25 GHZ PULSED MICROWAVES Final Report, 1 May 1988 - 30 Dec. 1991

HENRY KUES 13 Mar. 1992 28 p
(Contract DA PROJ. 3M1-61102-B5-15)
(AD-A249997) Avail: CASI HC A03/MF A01

This report is divided into 4 sections: general diagnostic evaluation; fluorophotometry; electroretinography; and histopathologic evaluation. At the end of the report, the results of all aspects of this study are summarized and discussed, and the findings are related to the exposure system. There is also a discussion of these findings in relation to recent observations on humans exposed to microwave radiation. GRA

N92-31143# Virginia Univ., Charlottesville. Dept. of Biology.
SUPPRESSION OF CIRCADIAN BEHAVIOR BY TRANSPLANTED SUPRACHIASMATIC NUCLEI Annual Report, 15 Nov. 1990 - 15 Aug. 1991

MICHAEL MENAKER 15 Aug. 1991 4 p
(Contract AF-AFOSR-0098-90)
(AD-A250442; AFOSR-92-0410TR) Avail: CASI HC A01/MF A01

A genetic mutation was found that alters the free running period of the locomotor activity rhythm from the wild-type value of approximately 24 hours to approximately 20 hours in homozygous mutants. Our data suggest the existence of two qualitatively different rhythmic outputs from the circadian oscillators contained within the SCN. One of these outputs stimulates the expression of locomotor activity producing activity rhythm's (which are seen within), and the other suppresses the expression of activity, restricting its appearance to a temporally defined window and thereby defining the boundaries of p'. The idea that one function of a circadian output from the SCN is to suppress activity is novel. GRA

N92-31167*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

LIGHT AS A CHRONOBIOLOGIC COUNTERMEASURE FOR LONG-DURATION SPACE OPERATIONS

ALEXANDER SAMEL, ed., PHILIPPA GANDER, ed. (San Jose State Univ., Moffett Field, CA.), JULIE EVANS, R. CURTIS GRAEBER (Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne, Germany, F.R.), ELIZABETH HACKETT (San Jose State Univ., CA.), LANNY KEIL, HARTMUT MAAB (Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne, Germany, F.R.), WOLFGANG RAABE (Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Cologne, Germany, F.R.), MARK ROSEKIND (Stanford Univ., Palo Alto, CA.), MIKE ROUNTREE (Stanford Univ., Palo Alto, CA.) et al. Dec. 1991 74 p
(Contract RTOP 505-64-13)
(NASA-TM-103874; A-91186; NAS 1.15:103874) Avail: CASI HC A04/MF A01

Long-duration space missions require adaptation to work-rest schedules which are substantially shifted with respect to earth. Astronauts are expected to work in two-shift operations and the environmental synchronizers (zeitgebers) in a spacecraft differ significantly from those on earth. A study on circadian rhythms, sleep, and performance was conducted by exposing four subjects to 6 deg head-down tilt bedrest (to simulate the effects of the weightless condition) and imposing a 12-h shift (6 h delay per day for two days). Bright light was tested in a cross-over design as a countermeasure for achieving faster resynchronization and regaining stable conditions for sleep and circadian rhythmicity. Data collection included objective sleep recording, temperature, heart rate, and excretion of hormones and electrolytes as well as performance and responses to questionnaires. Even without a shift

in the sleep-wake cycle, the sleep quantity, circadian amplitudes and 24 h means decreased in many functions under bedrest conditions. During the shift days, sleepiness and fatigue increased, and alertness decreased. However, sleep quantity was regained, and resynchronization was completed within seven days after the shift for almost all functions, irrespective of whether light was administered during day-time or night-time hours. The time of day of light exposure surprisingly appeared not to have a discriminatory effect on the resynchronization speed under shift and bedrest conditions. The results indicate that simulated weightlessness alters circadian rhythms and sleep, and that schedule changes induce additional physiological disruption with decreased subjective alertness and increased fatigue. Because of their operational implications, these phenomena deserve additional investigation. Author

N92-31326# Maryland Univ., Baltimore. School of Medicine.
ACETYLCHOLINESTERASE INHIBITORS ON THE SPINAL CORD Final Report, 1 Feb. 1986 - 30 Sep. 1989

JORDAN E. WARNICK 22 Nov. 1991 79 p
(Contract DAMD17-86-C-66030; DA PROJ. 3M1-62770-A-871)
(AD-A252694) Avail: CASI HC A05/MF A01

This report describes studies on organophosphorus (OP) inhibitors of acetylcholinesterase (AChE) in the mammalian spinal cord in which the mechanism and site of action of the OPs on synaptic transmission were studied with selective agonists and antagonists of putative central neurotransmitters. Spinal cords isolated from neonatal rats 5- to 9-days old were hemisected and placed in experimental chambers. Electrodes attached to dorsal and ventral root pairs recorded the monosynaptic (MSR) and polysynaptic reflexes (PSR). The roles of N-methyl-D-aspartate (NMDA) and non-NMDA receptors in the generation of MSRs and PSRs and in the action of AChE inhibitors were examined. Utilizing specific receptor inhibitors, it was found that the AChE inhibitors caused depression through muscarinic, not nicotinic receptors, that oximes antagonize AChE inhibitors by virtue of their anticholinergic actions, and not regeneration of ChE, and that thyrotropin releasing hormone can effectively reverse the depression of reflex activity. The facilitation caused by the AChE inhibitors was found to be caused by a block of bicuculline-sensitive inhibition. In addition, it was found that NMDA and non-NMDA receptors are present at synapses between the dorsal root afferent neuron and the excitatory interneuron in the PSR and between the dorsal root afferent neuron and motoneuron of the MSR. GRA

N92-31409# Oak Ridge National Lab., TN.
RADIATION PROTECTION FOR HUMAN EXPLORATION OF THE MOON AND MARS: APPLICATION OF THE MASH CODE SYSTEM

J. O. JOHNSON, R. T. SANTORO, J. D. DRISCHLER, and J. M. BARNES 1992 11 p Presented at the Nuclear Technologies for Space Exploration, Jackson, WY, 16-19 Aug. 1992
(Contract DE-AC05-84OR-21400)
(DE92-014416; CONF-920803-5) Avail: CASI HC A03/MF A01

The Monte Carlo Adjoint Shielding Code System (MASH), developed for the Department of Defense for calculating radiation protection factors for armored vehicles against neutron and gamma radiation, has been used to assess the dose from reactor radiation to an occupant in a habitat on Mars. The capability of MASH to reproduce measured data is summarized to demonstrate the accuracy of the code. The estimation of the radiation environment in an idealized reactor-habitat model is reported to illustrate the merits of the adjoint Monte Carlo procedure for space related studies. The reactor radiation dose for different reactor-habitat surface configurations to a habitat occupant is compared with the natural radiation dose acquired during a 500-day Mars mission. DOE

N92-31491# Medical Coll. of Virginia, Richmond. Dept. of Neurology.

THE EFFECTS OF HYDRAZINES OF NEURONAL EXCITABILITY Annual Report, 1 May 1989 - 31 May 1990

ROBERT J. DELORENZO 10 Jan. 1992 32 p
(Contract AF-AFOSR-0235-87)
(AD-A247142; AFOSR-92-0111TR) Avail: CASI HC A03/MF A01

Hydrazines (HZ) are toxic compounds which have numerous industrial applications including their use as missile propellants in advanced aircraft such as the F-16 and space vehicles. The extremely high toxicity of HZ's and the recurrent accidental exposure due to routine storage, use, and disposal of these compounds have created a significant health hazard among aerospace and defense industry personnel. HZ exposure can result in lethal complications involving repeated seizures and eventual respiratory collapse. Acute HZ exposure produces repeated tonic-clonic seizures in animals and man due to the strong convulsant properties of these compounds. In order to develop effective therapies for HZ toxicity, it is important to determine the mechanisms by which HZ's produce their neuronal excitatory effects. Initial studies in the laboratory of the electrophysiological effects of HZ's have shown that HZ exposure induces spontaneous and evoked epileptiform activity in mammalian hippocampus, recorded in vitro. In cultured hippocampal neurons, we have found that HZ's decrease the postburst after hyperpolarization, a primary postsynaptic mechanism utilized by many types of neurons to terminate bursts, and maintain a check on hyperexcitability. As expected, this AHP reduction by HZ's increases the rate of sustained repetitive firing in these neurons, and may be one mechanism contributing to HZ convulsant actions. GRA

N92-31492# Naval Health Research Center, San Diego, CA.
**BODY WATER HOMEOSTASIS AND HUMAN PERFORMANCE
IN HIGH HEAT ENVIRONMENTS: FLUID HYDRATION
RECOMMENDATIONS FOR OPERATION DESERT STORM**
Final Report, Feb. - Nov. 1991

B. L. BENNETT Nov. 1991 21 p
(Contract DA PROJ. M00-94)
(AD-A249772; NHRC-91-13) Avail: CASI HC A03/MF A01

Sustained operations during high temperatures increase the risk of heat illness. This risk can be lessened so that degradation in human performance does not impact substantially on military operations. Military personnel should obtain adequate heat acclimatization prior to moderate or heavy workloads, maintain strict fluid and food intake schedules, and alter workload to relative changes in air temperature. These factors will assist in maintaining body fluid balance. Prior to prolonged heat exposure, emphasis should be placed on achieving high aerobic fitness, becoming fully heat acclimated, and learning correct fluid hydration procedures. This will assist in greater physical performance at a lower core temperature in heat. These physiological benefits are ineffective during exposure to heat when individuals become dehydrated. Forced fluid hydration schedules will ensure that fluid intake will match fluid loss as sweat, thereby preventing the negative physiological effects of dehydration. GRA

N92-31554# Human Systems Div., Brooks AFB, TX
**MICRO SAINT MODEL OF FATIGUE ASSESSMENT Annual
Report, 1 Oct. 1990 - 30 Sep. 1991**

JONATHAN FRENCH 14 Jan. 1992 27 p
(Contract DA PROJ. 3M2-63002-D-995)
(AD-A249976) Avail: CASI HC A03/MF A01

Opportunities for fatigue-related accidents are greatest when extended duty cycles must be maintained. A means to plan for the influence of fatigue would be useful to best utilize crew resources. An equation was derived that predicts performance degradation associated with fatigued cognitive abilities. During a 30 hour sleep deprivation study, 9 male subjects were required to perform a 45 minute performance battery every 120 minutes and variables sensitive to fatigue were determined. Plasma melatonin levels also were obtained. Composite response time and accuracy scores were then derived. The equation that best described the composite scores included a linear component (hours awake weighting) and a circadian component (melatonin weighting). The respective prediction equations accounted for 36.7 and 36.9 percent of the variance in response time performance and 12.4 and 19.9 percent of the accuracy performance (p .001). These

percentages indicate that accuracy predictions were more enhanced by the circadian component than were those for response time. This work represents a mathematical description of fatigued performance that is sensitive to circadian cycles and requires minimal input data. The results might be used to recommend when additional crew should be employed as performance falls below critical thresholds or the best crew rest times during sustained operations. GRA

N92-31558# California Univ., Irvine. Dept. of Electrical and Computer Engineering.

**MODELING OF LEARNING-INDUCED RECEPTIVE FIELD
PLASTICITY IN AUDITORY NEOCORTEX Final Report, 1 Aug.
1989 - 31 Dec. 1991**

NORMAN M. WEINBERGER and JACK SKLANSKY 31 Dec.
1991 52 p
(Contract N00014-89-J-3187)
(AD-A250348) Avail: CASI HC A04/MF A01

A motivating assumption of this research is that insights into the structure and operation of the brain can inspire important ideas for the design of intelligent machines, in particular, machines that detect and classify auditory and visual signals buried in noise. In this project, we focus on the ability of the auditory cortex to adapt its sensitivity to pure tones. Our objective is a model of learning that will enable us to predict changes in the receptive fields of pyramidal cells in the auditory cortex in response to conditioning. Our model is constructed in two major parts: a local process that accounts for the preconditioned states of the pyramidal neurons, and a global process that accounts for the dispersed impact of conditioning across the pyramidal neurons. Recent findings in awake behaving animals have shown that neuronal tuning to acoustic features, e.g., frequency, is systematically altered in the auditory cortex as a result of learning. Responses to training signals are increased whereas responses to other stimuli are decreased, often enough to make the training signal become the most potent stimulus for a cell. This adaptive filtering appears to be a fundamental property of auditory signal processing. GRA

N92-31589# Brookhaven National Lab., Upton, NY.
MICRODISTRIBUTION OF LEAD IN BONE: A NEW APPROACH
K. W. JONES, R. S. BOCKMAN (Cornell Univ., New York, NY.),
and F. BRONNER (Connecticut Univ., Farmington.) 1991 17 p
Presented at the Workshop on Lead: Metabolism and Bone
Deposition, Upton, NY, 10-12 Apr. 1991

(Contract DE-AC02-76CH-00016)
(DE92-013036; BNL-47370; CONF-9104363-1) Avail: CASI HC
A03/MF A01

A knowledge of the microdistribution of lead in bone is important in order to understand the mechanisms for accumulation and release of lead. The availability of the synchrotron x-ray microscope for sensitive measurements of bone content and distribution of lead provides a valuable tool which, when combined with kinetic, balance, and tissue measurements, can lead to better evaluation of lead toxicity. It may also provide the basis for the development of a suitable model of how lead behaves in the human body. An outline of an experimental protocol for exploitation of the x-ray microscope is given, along with synchrotron x-ray microscope measurements of the distribution of gallium in rat bone that demonstrate the feasibility of the experimental approach. DOE

N92-31608# Lawrence Livermore National Lab., CA.
**BIODOSIMETRY OF IONIZING RADIATION IN HUMANS USING
THE GLYCOPHORIN A GENOTOXICITY ASSAY**

R. H. JENSEN, R. G. LANGLOIS, S. G. GRANT, and W. L.
BIGBEE 26 Jul. 1991 5 p Presented at the 9th International
Congress of Radiation Research (ICRR) Conference, Toronto
(Canada), 7-12 Jul. 1991

(Contract W-7405-ENG-48)
(DE92-011974; UCRL-JC-108024; CONF-9107136-11) Avail:
CASI HC A01/MF A01

Our assay for determining somatic mutations in humans detects variant erythrocytes that occur as a result of in vivo allele loss at the glycophorin A (GPA) locus in erythroid precursor cells in the

bone marrow. This gene codes for a cell surface sialoglycoprotein that occurs in two allelic forms, named the M and N forms, and is codominantly expressed on erythrocytes in peripheral blood of people who are heterozygous at the GPA locus. With our assay, which is performed only on GPA(MN) heterozygotes, we are able to detect rare variant erythrocytes that have lost expression of one of the two GPA alleles. Two different variant cell types are detected. One termed N(O) variant cells, is hemizygous. Such cells might arise by mutation, deletion or inactivation of the GPA(M) allele or loss of chromosome carrying that allele in erythroid precursor cells. Our assay also detects homozygous variant erythrocytes that have lost expression of the GPA(M) allele and express the GPA(N) allele at twice the heterozygous level. These NN variant cells would be generated by chromosomal loss and duplication, gene conversion or mitotic recombination in erythroid precursor cells. The GPA assay requires expression of GPA(N), thus guaranteeing that all variant cells are capable of normally expressing this cell surface antigen. The result of this assay is an enumeration of the frequency of N(O) and NN variant cell types for each individual analyzed. Such variant cell frequencies provide a measure of the quantity of somatic cell mutations that have occurred at the GPA locus. If the relationship between the mutations expressed at the GPA locus and the onset of cancer induced by radiation can be developed, this assay may serve as an effective monitoring method for people at high risk for exposure to ionizing radiation with a cancer risk estimation linked to the results of this monitor. DOE

N92-31905# Pittsburgh Univ., PA. Dept. of Psychiatry.
ORGANIZATION OF THE HUMAN CIRCADIAN SYSTEM Annual Report, 1 Feb. 1991 - 31 Jan. 1992
ROBERT Y. MOORE 31 Jan. 1992 5 p
(Contract AF-AFOSR-0175-91)
(AD-A247498; AFOSR-92-0219TR) Avail: CASI HC A01/MF A01

As in the prior material, the largest population of neurons in the Human SCN contains NT. These are distributed throughout the nucleus and are accompanied by a dense axonal plexus which is probably intrinsic. The NT plexus is uniformly dense throughout the SCN with numerous, small varicosities. These are distributed in a pattern that indicates the synapses are predominantly axodendritic. The second largest population of neurons is VP-containing. These also are widely distributed but perikarya are not present in the ventral-medial portion of the nucleus. The VP plexus is also dense and the distribution of axons also indicates a predominantly axodendritic synapse organization. NPY-containing neurons are found predominantly in the central part of the SCN. There is a dense, and quite coarse, plexus of varicosities and axons peripherally with many fewer axons in the area of NPY cell bodies. The plexus includes a set of very fine fibers and varicosities that presumably arise either from the SCN neurons or the lateral geniculate. VIP perikarya are located very ventrally and medially in the nucleus. Axons project through the nucleus and out into the adjacent interior hypothalamus. The area innervated by these VIP fibers appears much wider than in the rat and includes the paraventricular nucleus. GRA

N92-31962# Air Force Inst. of Tech., Wright-Patterson AFB, OH.

NONTHERMAL INHALATION INJURY M.S. Thesis

PATRICIA M. MILLER 1992 68 p
(AD-A252532; AFIT/CI-CIA-92-010) Avail: CASI HC A04/MF A01

Inhalation injury is one of the leading factors in the deaths of burn patients and is the leading cause of death at the scene of fires. Research into sepsis and burn care have taken precedence since 1960. Only recently have researchers taken a closer look at smoke inhalation and its effects. With the increased use of synthetic materials in buildings, furniture, and clothes there is a need for emergency personnel to understand the effects of the various byproducts of combustion on the human body. A thorough knowledge of the physiological mechanisms, relevant assessment parameters, and treatment modalities related to smoke inhalation enables the emergency CNS to provide expert care. The CNS

must then use this knowledge to provide education to emergency and prehospital staff. The emergency CNS may also play a large role in the current research on new treatments. This paper reviews the physiology, assessment, and treatment of inhalation injuries. Suggestions are also made regarding how the emergency CNS can incorporate this knowledge into the roles of the CNS. GRA

N92-31963# Naval Biodynamics Lab., New Orleans, LA.
NAVAL BIODYNAMICS LABORATORY: 1989 AND 1990 COMMAND HISTORY

Jul. 1991 95 p
(AD-A247185) Avail: CASI HC A05/MF A01

The Naval Biodynamics Laboratory (NAVBIODYNLAB) was established as the Naval Aerospace Medical Research Laboratory Detachment (NAMRLD) in April 1971 by the Bureau of Medicine and Surgery (BUMED). NAMRLD was a detachment of the Naval Aerospace Medical Research Laboratory which is located at the Naval Air Station, Pensacola, Florida. The initial purpose of the Detachment was to study human response to impact acceleration. In 1975, the mission was expanded to include human response to vibration, ship motion, and human performance. NAVBIODYNLAB was designed a separate command by the Secretary of the Navy in February, 1980, and officially established by OPNAV NOTICE 5450 on 28 February 1980. GRA

N92-32107# Research Triangle Inst., Research Triangle Park, NC.

NONINVASIVE AMBULATORY ASSESSMENT OF CARDIAC FUNCTION AND MYOCARDIAL ISCHEMIA IN HEALTHY SUBJECTS EXPOSED TO CARBON MONOXIDE Midterm Report, 8 Apr. 1991 - 7 Feb. 1992

PAUL N. KIZAKEVICH, MICHAEL L. MCCARTNEY, and MILAN J. HAZUCHA 6 Mar. 1992 32 p
(Contract DAMD17-91-C-1007; DA PROJ. 3M1-62787-A-878)
(AD-A252264) Avail: CASI HC A03/MF A01

Carbon monoxide is of continuing interest to the military community. The transient nature of weapons firing, the spatial distribution of CO concentration, and differences in individual physiology will cause the CO dose to vary significantly among crewmembers. Continuous and noninvasive ambulatory monitoring of cardiopulmonary measurements in situ may provide an understanding of the effects of CO exposure among crewmembers in the field environment. This project evaluates the utility of combined impedance and electrocardiographic estimators of cardiac function during exercise in air and with exposure to CO. Treadmill exercise is included on test subjects for comparison with the existing body of data on exercise performance in asymptomatic patients and the body of data which reflects performance decrements with exercise and CO in normals. Upper body exercise is included to test the hypothesis that this form of exercise places a greater strain on the cardiovascular system than lower body exercise, both with and without CO exposure. All of the accomplished work to date has involved preparatory tasks, therefore no experimental results are reported. The midterm report does discuss the literature review, the experiment plan, and the development of a human exposure facility for executing the planned experiments. GRA

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BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

A92-50174

RESULTS OF THE ESA STUDY ON PSYCHOLOGICAL SELECTION OF ASTRONAUT APPLICANTS FOR COLUMBUS MISSIONS. I - APTITUDE TESTING. II - PERSONALITY ASSESSMENTS

CHRISTOPH FASSBENDER and KLAUS-MARTIN GOETERS (DLR, Hamburg, Federal Republic of Germany) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 131-145. refs
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Aptitude and personality testing methods for the Columbus missions are set forth which are used in candidate selection for long-duration space flights. The aptitude testing includes a battery of psychometric tests to examine logical reasoning, memory function, spatial orientation, and psychomotor function. All but two of the subjects tested are found to have good psychometric qualities, and the test methods are found to be free from cultural biases. Personality-assessment tests include questionnaires, group problem solving, and projective techniques, and the results are also found to be culture-fair tests of psychometric qualities. The results of the test batteries are used to choose testing techniques for a decisive test of ESA astronaut applicants. C.C.S.

A92-50175 PSYCHOLOGICAL TRAINING OF GERMAN SCIENCE ASTRONAUTS

DIETRICH MANZEY and ALBRECHT SCHIEWE (DLR, Institut fuer Flugmedizin, Hamburg, Federal Republic of Germany) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 147-154. refs
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A program is advanced for psychological training of astronauts which focuses on the skills needed for long-duration spaceflight and on the skills needed to cope with the premission phase. The psychological training procedures include seminars on communication and cooperation, stress management, coping with operational demands, group problem solving, and problem-oriented team supervision. Communication training focuses on intergroup understanding, and relaxation techniques are taught to the candidates as a stress-management technique. Practical simulations with video games are used to study performance under high operational demands, and role playing is employed to work on logical problem solving techniques. The present psychological training is expected to: (1) improve the social competence of astronaut candidates; (2) support the team-building process in the astronaut team; and (3) increase the general efficiency of the astronauts through enhanced performance skills. C.C.S.

A92-50281 THE EFFECT OF TRANS-COCKPIT AUTHORITY GRADIENT ON NAVY/MARINE HELICOPTER MISHAPS

ROBERT A. ALKOV, MICHAEL S. BOROWSKY, DANA W. WILLIAMSON, and DAVID W. YACAVONE (U.S. Navy, Naval Safety Center, Norfolk, VA) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 63, no. 8, Aug. 1992, p. 659-661. refs
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Navy and Marine Corps helicopter mishaps which had a pilot causal factor assigned were examined to determine if the relative military rank of the pilot and copilot was associated with the rate of occurrence per 100,000 flight hours. All class A and B helicopter flight mishaps for the 11 calendar year period 1980-1990 were examined. Although no statistically significant differences were noted, pairing pilots who were of equal rank yielded the lowest rate, seemingly refuting Elwyn Edward's notion that a flat 'trans-cockpit authority gradient' may lead to greater problems in the cockpit than his hypothetical 'optimum gradient'. Moreover, when copilots flew with pilots who differed by two or more ranks, the largest pilot error rate was revealed. This last finding seems to support Edward's hypothesis that a steep 'trans-cockpit authority gradient' may be detrimental to aviation safety. Author

A92-50291 CREWMEMBER COMMUNICATION IN SPACE - A SURVEY OF ASTRONAUTS AND COSMONAUTS

ALAN D. KELLY (Applied Communications Corp., San Mateo, CA) and NICK KANAS (USVA, Medical Center; California, University, San Francisco) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 63, no. 8, Aug. 1992, p. 721-726. refs
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A total of 54 astronauts and cosmonauts returned questionnaires which addressed various aspects of crewmember communication in space. All respondents believed that crewmembers should be fluent in one shared common language, but American and Soviet space travelers were less tolerant of dialect differences than their international counterparts. Sensory activities (Watching and Listening) were rated as significantly increasing in space, whereas more complex communicative activities (Reading, Gesturing, and Writing) were judged to significantly decrease. Cosmonauts scored higher than astronauts in all verbal and nonverbal activities, possibly reflecting more responsiveness to the space environment. Several factors were rated as significantly helping intracrew communication: Shared Experience, Excitement of Space Flight, Close Quarters, and Isolation from Earth. Other factors were judged to significantly hinder communication: Facial Swelling, Spacecraft Ambient Noise, and Space Sickness. These findings have important operational and scientific implications involving future manned space missions. Author

A92-52429# TECHNOLOGY APPLICATIONS FOR ARMY HELICOPTER CREW TRAINING

SAMUEL KNIGHT and ROBERT MONETTE (CAE-Link Corp., Binghamton, NY) IN: AIAA/AHS Flight Simulation Technologies Conference, Hilton Head Island, SC, Aug. 24-26, 1992, Technical Papers. Washington, American Institute of Aeronautics and Astronautics, 1992, p. 16-20.

(AIAA PAPER 92-4132) Copyright

An overview of simulation technologies and other techniques for training helicopter crews is presented detailing the hierarchy of training devices and an example of their application. The training-device hierarchy is illustrated which incorporates classroom and part-task trainers, cockpit procedural trainers, flight simulators, flight/weapons simulators, and combat-mission simulators. Specific descriptions are given of some of the simulation devices showing their applications to helicopters, and the AH-64 Combat Mission Simulator is shown to be a highly complex training device. The training devices are shown to be useful in training crew for the AH-64 Apache aircraft transition and for the RAH-66 Comanche because they provide safe and economical training in the absence of nonsimulation training resources. C.C.S.

A92-52430*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

DOES A MOTION BASE PREVENT SIMULATOR SICKNESS?

THOMAS J. SHARKEY and MICHAEL E. MCCAULEY (Monterey Technologies, Inc., Carmel, CA) IN: AIAA/AHS Flight Simulation Technologies Conference, Hilton Head Island, SC, Aug. 24-26, 1992, Technical Papers. Washington, American Institute of Aeronautics and Astronautics, 1992, p. 21-28. Research supported by U.S. Army. refs

(Contract NAS2-12927)

(AIAA PAPER 92-4133) Copyright

The use of high-fidelity motion cues to reduce the discrepancy between visually implied motion and actual motion is tested experimentally using the NASA Vertical Motion Simulator (VMS). Ten pilot subjects use the VMS to fly simulated S-turns and sawtooths which generate a high incidence of motion sickness. The subjects fly the maneuvers on separate days both with and without use of a motion base provided by the VMS, and data are collected regarding symptoms, dark focus, and postural equilibrium. The motion-base condition is shown to be practically irrelevant with respect to the incidence and severity of motion sickness. It is suggested that the data-collection procedure cannot detect differences in sickness levels, and the false cues of the motion condition are theorized to have an adverse impact approximately

equivalent to the absence of cues in a fixed-base condition.

C.C.S.

A92-52431#

SIMULATOR INDUCED ALTERATION OF HEAD MOVEMENTS (SIAHM)

ROBERT T. HENNESSY, THOMAS J. SHARKEY, JOY A. MATSUMOTO (Monterey Technologies, Inc., Carmel, CA), and JAMES W. VOORHEES (Advanced Simulation Engineering, Vancouver, WA) IN: AIAA/AHS Flight Simulation Technologies Conference, Hilton Head Island, SC, Aug. 24-26, 1992, Technical Papers. Washington, American Institute of Aeronautics and Astronautics, 1992, p. 29-36. refs
(AIAA PAPER 92-4134) Copyright

Head movements are measured in pilot subjects while they use a helicopter flight simulator to determine whether exposure to simulated flight causes alterations in the head movements during actual flight. The maneuvers simulated include S-turns and sawtooth paths known to induce simulator sickness, and an IR device in the simulator helmet is used to study head motion. The six test pilots experienced moderate-severe simulator sickness, and a pronounced reduction is noted in the yaw head movements of pilots during actual helicopter flight following simulator flights. It is theorized that the pilots attempt to control the adverse effects related to the simulator experience by limiting their head motions and the acceleration of the aircraft. The head-movement data support the hypothesis that simulator-induced sickness experiences lead to reduced head movements in flight.

C.C.S.

A92-52461*# National Aeronautics and Space Administration. Langley Research Center, Hampton, VA.

EFFECT OF DISPLAY PARAMETERS ON PILOTS' ABILITY TO APPROACH, FLARE AND LAND

VERNON M. BATSON, RANDALL L. HARRIS, SR., and JACOB A. HOUCK (NASA, Langley Research Center, Hampton, VA) IN: AIAA/AHS Flight Simulation Technologies Conference, Hilton Head Island, SC, Aug. 24-26, 1992, Technical Papers. Washington, American Institute of Aeronautics and Astronautics, 1992, p. 322-332. refs

(AIAA PAPER 92-4139) Copyright

A workstation study is undertaken in which pilots conduct simulated landings via video images, and the effects are evaluated of field of view (FOV), magnification, resolution, update rate, and the use of aiding symbology. The simulation is conducted on the Advanced Real-time Simulation System with real-time controls, computer-generated imagery, and cockpit instrument displays. Five pilots fly 45 test runs with varying levels of FOV, update rate, aiding symbology, resolution, and magnification. Increased FOVs improve the runway streaming cues, and the pilots are shown to prefer unity magnification. Aiding symbology is shown to improve flare initiation and approach-heading variation, and the pilots prefer to use aiding symbology during the landing task. Update rate is also shown to have a critical effect on the pilots' ability to land the simulated aircraft.

C.C.S.

A92-52527

SIMULATOR SICKNESS IS POLYGENIC AND POLYSYMPTOMATIC - IMPLICATIONS FOR RESEARCH

ROBERT S. KENNEDY and JENNIFER E. FOWLKES (Essex Corp., Orlando, FL) International Journal of Aviation Psychology (ISSN 1050-8414), vol. 2, no. 1, 1992, p. 23-38. Research supported by U.S. Navy and Martin Marietta Energy Systems, Inc. refs
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Problems of interest in research of simulator sickness are discussed focusing on effective research strategies. The study uses an extensive simulator sickness data base collected from more than 2,000 exposures from 10 Navy simulators and a statistical power analysis that makes it possible to formalize the difficulty in quantifying design factors implicated in simulated sickness and to estimate the sensitivity of experiments investigating these effects. It is suggested that improved simulated design criteria can best be studied in 'field experiments' in which large sample

studies permit the relatively small effects of several different simulator-equipment features to be isolated, contrasted, and revealed.

O.G.

A92-53001

PSYCHOLOGICAL PROBLEMS ON A SPACE STATION

MINORU KUME (Waseda University; NASDA, Tokyo, Japan), SEI YUMIKURA, MAKOTO DOI, and CHIHARU SEKIGUCHI (NASDA, Tokyo, Japan) Japanese Journal of Aerospace and Environmental Medicine (ISSN 0387-0723), vol. 29, no. 1, March 1992, p. 1-15. In Japanese. refs

Copyright

Research on psychological problems, associated with isolation and confinement, that may occur on a space station is discussed. Space flight simulation testing is described, and mental health factors in space flight are discussed. Psychological support for crew members on a space station is described.

Y.P.Q.

N92-30254# Logicon Technical Services, Inc., Dayton, OH.

REVIEW OF PSYCHOPHYSICALLY-BASED IMAGE QUALITY METRICS Final Report, Jun. 1990 - May 1991

JENNIE J. GALLIMORE Sep. 1991 47 p Prepared in cooperation with Wright State Univ., Dayton, OH
(Contract F33615-89-C-0532)

(AD-A251053; AL-TR-1991-0153) Avail: CASI HC A03/MF A01

There have been many advances in imaging technologies resulting in a variety of techniques for generation, coding for transmission, image processing, decoding, and display of information. In addition to the development of techniques, investigators have recognized the need for quantitative measures of image distortion and/or image quality corresponding to observer performance and observer impressions of the images. The purpose of this report is to review current psychophysically based measures of image quality for possible application to compressed or transmitted sensory imagery. This report briefly reviews human vision models, image quality metrics, empirical modelling approaches to image quality, discusses current research needs, and provides recommendations for immediate application to compressed digital images.

GRA

N92-30306*# Bolt, Beranek, and Newman, Inc., Cambridge, MA. Systems and Technologies.

A PRINCIPLED APPROACH TO THE MEASUREMENT OF SITUATION AWARENESS IN COMMERCIAL AVIATION

YVETTE J. TENNEY, MARILYN JAGER ADAMS, RICHARD W. PEW, A. W. F. HUGGINS, and WILLIAM H. ROGERS Washington NASA Jul. 1992 32 p

(Contract NAS1-18788; RTOP 505-64-13-21)

(NASA-CR-4451; NAS 1.26:4451; BBN-7451) Avail: CASI HC A03/MF A01

The issue of how to support situation awareness among crews of modern commercial aircraft is becoming especially important with the introduction of automation in the form of sophisticated flight management computers and expert systems designed to assist the crew. In this paper, cognitive theories are discussed that have relevance for the definition and measurement of situation awareness. These theories suggest that comprehension of the flow of events is an active process that is limited by the modularity of attention and memory constraints, but can be enhanced by expert knowledge and strategies. Three implications of this perspective for assessing and improving situation awareness are considered: (1) Scenario variations are proposed that tax awareness by placing demands on attention; (2) Experimental tasks and probes are described for assessing the cognitive processes that underlie situation awareness; and (3) The use of computer-based human performance models to augment the measures of situation awareness derived from performance data is explored. Finally, two potential example applications of the proposed assessment techniques are described, one concerning spatial awareness using wide field of view displays and the other emphasizing fault management in aircraft systems.

Author

N92-30320# Texas Univ., Houston. Dept. of Neurobiology and Anatomy.

ANALYSIS AND SYNTHESIS OF ADAPTIVE NEURAL ELEMENTS AND ASSEMBLES Annual Report, 1 Oct. 1990 - 30 Sep. 1991

JOHN H. BYRNE 17 Feb. 1992 15 p

(Contract AF-AFOSR-0027-91)

(AD-A248467; AFOSR-92-0212TR) Avail: CASI HC A03/MF A01

Between 1 Oct. 1990 and 30 Sep. 1991, progress was made in six areas. First, voltage-clamp experiments investigated the modulation of the voltage-dependent $K(+) current (I_{K,v})$ by serotonin (5-HT). Second, a computer program that is a general-purpose Simulator for Neural Networks and Action Potentials (SNNAP) was developed. Third, extensions were made to the single-cell model of associative learning by incorporating Hodgkin-Huxley type membrane currents, descriptions of the modulation of membrane currents by 5-HT, and a model of intracellular Ca^{2+} diffusion. Fourth, SNNAP was used to investigate the role of interneurons in determining the intensity and duration of motor neuron responses that mediate the tail-withdrawal reflex. Fifth, experiments characterized the synaptic interactions among the neurons of a central pattern generator (CPG) that underlies aspects of feeding behavior. Sixth, SNNAP was used to begin simulating the neurons and synaptic connections of the feeding CPG. In addition, work on the model of the bursting neuron R15 was completed. GRA

N92-30325# North Carolina Univ., Chapel Hill.
SPATIOTEMPORAL CHARACTERISTICS OF HUMAN VISUAL LOCALIZATION Final Report, 1 Oct. 1990 - 31 Dec. 1991

CHRISTINA A. BURBECK 28 Feb. 1992 62 p

(Contract AF-AFOSR-0058-91)

(AD-A248494; AFOSR-92-0203TR) Avail: CASI HC A04/MF A01

Psychophysical studies of the processes underlying relative localization in human vision were conducted. Specifically, the focus of this granting period was characterizing the spatial characteristics of the units that encode spatial location. Evidence was found for a higher-order scaled representation of position in which the size of position integration areas scales with the distance being encoded. This scaling of the position integration areas was found to account well for the increase in separation discrimination thresholds with increasing separation. The position integration areas were shown not to integrate luminance, but were shown to depend on an initial spatial organization of the scene. The time course of the position integration was also investigated. Additional studies investigated the relationship between position integration and the Muller-Lyer illusion, and the effect of the spatial frequency of a masking stimulus (presented at termination of the separation discrimination stimulus) on separation discrimination thresholds. GRA

N92-30336# Stanford Univ., CA. Dept. of Psychology.
INDUCED PICTORIAL REPRESENTATIONS Annual Technical Report, 1 Feb. 1991 - 31 Jan. 1992

BARBARA G. TVERSKY 28 Feb. 1992 11 p

(Contract AF-AFOSR-0076-89)

(AD-A248560; AFOSR-92-0231TR) Avail: CASI HC A03/MF A01

On many occasions, such as giving directions, spatial situations are described in words rather than depicted. In comprehending such descriptions, people form mental representations of the situation described by the discourse as well as representations of the text. This project investigates spatial mental models induced by words for large-scale and for immediate environments. The results simultaneously elucidate spatial thinking, text comprehension, and text construction. The experiments using large-scale environments focus on the comprehension and production of various kinds of descriptive text. The experiments using immediate environments focus on on-line use of spatial mental models and updating under changes in point of view. New research is expanding both projects, including investigations of construction of mental models. GRA

N92-30488# Federal Aviation Administration, Atlantic City, NJ.
TECHNICAL TRAINING FOR NATIONAL SIMULATOR EVALUATION SPECIALIST

THEOS D. MCKINNEY, JR. Jun. 1992 36 p

(NASA-CR-190429; NAS 1.26:190429; DOT/FAA/CT-TN92/14)

Avail: CASI HC A03/MF A01

The technical training needs of the Federal Aviation Administration (FAA) specialists who evaluate and qualify FAA recognized flight training simulators and devices are examined. The need for this training is established, and sources and methodologies are recommended for initial, maintenance, and update courses. Author

N92-30613# Hahnemann Medical Coll. and Hospital, Philadelphia, PA. Dept. of Physiology and Biophysics.

CORTICAL MECHANISMS OF ATTENTION, DISCRIMINATION, AND MOTOR RESPONSE TO SOMAESTHETIC STIMULI

Annual Report, 1 Apr. 1990 - 31 Mar. 1991

JOHN K. CHAPIN 1 Dec. 1991 7 p

(Contract AF-AFOSR-0266-90)

(AD-A247228; AFOSR-92-0108TR) Avail: CASI HC A02/MF A01

The overall aim of this research is to investigate the neural circuit mechanisms of attentional and discriminative processing of somatosensory stimuli which are cues for limb movement. These issues are being addressed mainly through use of multi-single neuron recording techniques, which we have recently developed. In the past granting period this approach has been used to record from ensembles of single neurons through microwire electrode arrays chronically implanted in the forepaw/forelimb areas of the somatosensory (SI) and motor (MI) cortices in awake behaving rats. These animals are trained to place their forepaw on a bar and move it up or down immediately upon detecting a vibratory stimulus imposed on the bar. Initially, only neurons in the SI responded to the sensory cue. After the rat learned to perform to criterion in the task, however, neurons in the MI cortex also responded at relatively short latency to the sensory cue. This suggests that transmission through a trans-cortical sensorimotor loop can be enhanced through training. Additional progress has been made on several other projects which provide necessary background information for this investigation. GRA

N92-30679# Harvard Univ., Cambridge, MA.
PSYCHOPHYSICAL STUDIES OF VISUAL CORTICAL FUNCTION Final Technical Report, 1 Sep. 1988 - 31 Aug. 1991

KEN NAKAYAMA 12 Jan. 1992 7 p

(Contract AF-AFOSR-0330-90)

(AD-A246962; AFOSR-92-0096TR) Avail: CASI HC A02/MF A01

Our goal was to understand visual cortical function using psychophysical techniques. In particular, we examined visual attention, visual search, visual surface representation, and color filling-in. In visual attention, we found evidence to suggest two components of focal attention, a transient and a sustained process. We also provided evidence for the role of attention in saccadic eye movements by showing rapid deployment of attention in the gap paradigm. In visual search, we found a particular situation where increasing distractor number led to decreasing reaction times, suggesting a different role for attention in such tasks. In visual surface representation, we outlined the role of surface encoding (border ownership, modal and amodal completion, transparency) in many visual tasks. From these studies we postulated the principle of generic image sampling, a hypothesis which provides a geometric tool to understand visual surface learning. We also have investigated the perception of depth from unpaired points (DaVinci stereopsis), showing that such points lead to depth and subjective contours. In color filling-in, we have explored spatial-temporal dynamics and have created a neural model. GRA

N92-31291# Reading Univ. (England).
THEORY AND TEST OF STRESS RESISTANCE Final Report, Nov. 1990 - Nov. 1991

FRANK P. MCKENNA and DINKAR SHARMA Apr. 1992 41 p
(Contract DAJA45-90-C-0031)
(AD-A250741; ARI-RN-92-22) Avail: CASI HC A03/MF A01

In this report, we developed a laboratory model to test hypotheses concerning the disruptive effects of emotional stimuli. The research assesses the potential of the computerized emotional Stroop task. We discovered that the task was sensitive to two important elements of stress resistance, threat and habituation. The Stroop task is sensitive to the nature of the stimuli, namely that threatening stimuli can be distinguished from nonthreatening stimuli and that with stimulus repetition the stimuli show effects of habituation. Important findings emerged from the research in the following areas. Time pressure and task difficulty. One of the most important findings demonstrates the importance of time pressure and information load on overall performance and the adaptive process that eliminates emotional interference. When an individual is under time pressure and/or is performing a difficult task, there is greater emotional interference than when there is no time pressure or the task is easy. The important role that time pressure and task difficulty play in tasks such as this has not, to this point, been acknowledged. GRA

N92-31321# Eagle Technology, Inc., Winter Park, FL.
**DEVELOPMENT OF QUANTITATIVE SPECIFICATIONS FOR
SIMULATING THE STRESS ENVIRONMENT Final Report, Jul.
1989 - May 1991**

JAMES E. DRISKELL, BRIAN MULLEN, CRAIG JOHNSON, SANDY HUGHES, and CHERYL L. BATCHELOR Mar. 1992 210 p
(Contract F33615-89-C-0008)
(AD-A250669; AL-TR-1991-0109) Avail: CASI HC A10/MF A03

This report is a culmination of work originally started in 1988. The combat maintenance environment is an environment that, to date, has not yet been clearly defined but is extremely important to our success in future combat. These maintenance personnel, although highly trained and skilled technicians, receive little preparation for the extreme stresses of the combat environment. To determine the parameters of that environment, the literature has offered few solutions. However, by utilizing a meta-analytic technique to identify the stress factors that restrict or limit effective performance, we can develop specifications for simulating the stress environment. This report identifies specific ranges to induce stress in the areas of noise, time, pressure, group pressure, threat, uncontrollability, fatigue, dual tasks, and heat and cold. In addition, further research avenues are recommended. GRA

N92-31341*# Georgia Inst. of Tech., Atlanta. Center for Human-Machine Systems Research.
**ACQUISITION AND PRODUCTION OF SKILLED BEHAVIOR IN
DYNAMIC DECISION-MAKING TASKS Status Report, 31 Jan. -
31 Jul. 1992**

ALEX KIRLIK 31 Jul. 1992 159 p
(Contract NAG2-656)
(NASA-CR-190614; NAS 1.26:190614) Avail: CASI HC A08/MF A02

Detailed summaries of two NASA-funded research projects are provided. The first project was an ecological task analysis of the Star Cruiser model. Star Cruiser is a psychological model designed to test a subject's level of cognitive activity. Ecological task analysis is used as a framework to predict the types of cognitive activity required to achieve productive behavior and to suggest how interfaces can be manipulated to alleviate certain types of cognitive demands. The second project is presented in the form of a thesis for the Masters Degree. The thesis discusses the modeling of decision-making through the use of neural network and genetic-algorithm machine learning technologies. D.R.D.

N92-31392# Air Force Inst. of Tech., Wright-Patterson AFB, OH.

**IN-FLIGHT DECISION MAKING BY HIGH TIME AND LOW TIME
PILOTS DURING INSTRUMENT OPERATIONS M.S. Thesis**

KENNETH L. KEMPER 1992 98 p
(AD-A249990) Avail: CASI HC A05/MF A02

This study examined decision-making in high and low-time

pilots (n = 26) on a simulated IFR cross-country flight using MIDIS 3.0, a microcomputer-based flight-decision simulator. When confronted with situations which could endanger the safety and/or efficiency of the flight, it was hypothesized that high-time pilots would recognize the cues relevant to the problem, pattern match these cues with a situational schemata, or script, from long term memory (LTM), and choose to execute their first workable solution. It was hypothesized that low-time pilots would also attempt the same decision-making strategy, but because of their smaller experiential repertoires would fail to make a pattern match in LTM. It was posited that novices then are forced to use a utility strategy in which they must integrate cues with declarative knowledge, generate alternatives, evaluate outcomes, and finally choose the alternative calculated to bring the most utility. The difference in strategies was hypothesized to lead high-time pilots to choose more optimal solutions. The results clearly show that high-time pilots decision optimality is significantly better than low-time pilots. GRA

N92-31444# Educational Testing Service, Princeton, NJ.
**PROBABILITY-BASED INFERENCE IN A DOMAIN OF
PROPORTIONAL REASONING TASKS**

ANNE BELAND and ROBERT J. MISLEVY Jan. 1992 62 p
(Contract N00014-88-K-0304; N00014-91-J-4101)
(AD-A247304; ETS-RR-92-15-ONR) Avail: CASI HC A04/MF A01

Educators and psychologists are increasingly interested in modelling the processes and knowledge structures by which people learn and solve problems. Progress has been made in developing cognitive models in several domains, and in devising observational settings that provided clues about subject's cognition from this perspective. Less attention has been paid to procedures for inference or decision making with such information, given that it provides only imperfect information about cognition - in short, test theory for cognitive assessment. This paper describes probability based inference in this context, and illustrates its application with an example concerning proportional reasoning. GRA

N92-31472# York Univ. (Ontario). Human Performance in Space Lab.

**ILLUSORY SELF MOTION AND DISORIENTATION Final
Report**

IAN P. HOWARD 12 Sep. 1989 94 p
(Contract DCIEM-07SE-W7711-7-7012)
(CTN-92-60318) Avail: CASI HC A05/MF A01

An illusion of self motion and disorientation is experienced by persons viewing a large moving display. This report describes work undertaken to reinvestigate several of the assumed properties of suchvection. These results relate to the practical problems of motion sickness and disorientation experienced in moving vehicles and to the fidelity of visual stimuli used to generate sensations of self-motion in simulators. Results of the investigations are as follows. The visual display presented in a flight simulator does not have to be large to generate a convincing sense of self motion. If a surrounding part of a large visual display is moving in one direction and a smaller central display is moving in the opposite direction, the direction ofvection is determined by the surround display, even when the central display is the more distant. When the central display occupies the same area as the surround display, the sense ofvection was controlled by whichever was more distant. Thus, factors of relative size and distance are more important to the sense ofvection than is the factor of central or peripheral placement.vection is driven more effectively by movement perceived in the upper visual field than in the lower. People with bilateral loss of vestibular function did not experience the limited degree of illusory tilt experienced by normal subjects when subjected to pitch and rollvection. Stationary objects were found to inhibitvection only when they were more distant than the moving display. CISTI

N92-31758# Rochester Univ., NY.
**FUNCTION OF PANEL M PATHWAYS IN PRIMATES Final
Technical Report, 1 Oct. 1988 - 30 Sep. 1991**

WILLIAM MERIGAN 13 Apr. 1992 4 p

(Contract AF-AFOSR-0041-89)

(AD-A250275; AFOSR-92-0347TR) Avail: CASI HC A01/MF A01

Psychophysical threshold measures were used in combination with precisely located lesions of the sub-cortical visual pathway to examine segregation of function between P and M pathways. Scleral search coils monitored fixation locus in the tested monkeys, to insure that test stimuli were presented in visual field regions corresponding to the lesion location. Results of these studies indicated that the P pathway (or color-opponent pathway) is the major contributor to visual acuity, color vision, and luminance contrast sensitivity. On the other hand, the M pathway (or broad contours), as well shows sensitivity to rapidly drifting visual stimuli. A special role for the M pathway in the processing of visual motion was ruled out by determining its contribution to directional and velocity sensitivity. GRA

N92-31779# Harvard Univ., Cambridge, MA. Dept. of Psychology.

FORMS OF MEMORY FOR REPRESENTATION OF VISUAL

OBJECTS Annual Report, 15 Feb. 1991 - 14 Feb. 1992

DANIEL L. SCHACTER 14 Feb. 1992 8 p

(Contract AF-AFOSR-0182-91)

(AD-A250056; AFOSR-92-0234TR) Avail: CASI HC A02/MF A01

Considerable progress has been made during the past year toward achieving the project's main goals of elucidating the representations and processes involved in implicit and explicit memory for novel visual objects. Experiments have been completed or initiated that: (1) clarify the effects of structural and functional encoding manipulations on priming and explicit memory; (2) help to specify the nature of the structural representation that underlies priming effects on the object decision task; (3) extend findings on priming of novel objects to tests other than possible/impossible object decision; (4) elucidate the extent to which implicit memory for novel objects is spared in subject populations with explicit memory deficits; and (5) examine conditions under which priming of novel objects may be observed. GRA

N92-32020 Ocean Planet Odyssey, New York, NY.

ONE THOUSAND DAYS NON-STOP AT SEA: LESSONS FOR A MISSION TO MARS

REID STOWE and ALBERT A. HARRISON (California Univ., Davis.) In Huntsville Association of Technical Societies, TABES 92: 8th Annual Technical and Business Exhibition and Symposium. Executive Summaries and Submitted Papers 14 p 1992

(TABES PAPER 92-462) Copyright Avail: Issuing Activity

Plans for the exploration and settlement of space include a manned mission to Mars in the early twenty-first century. Among the many issues that must be addressed prior to the departure of the first Mars crew, are those regarding crewmember adaptation to a three year mission. During fall of 1993, the schooner Anne, bearing a crew of six to eight members will undertake a 1000 day voyage without touching land or receiving supplies from another craft. The purpose of this expedition includes the evaluation of equipment, supplies, and humans under conditions of isolation and confinement that will resemble some of those of the initial Mars voyage. The present paper describes some of the psychological support and research activities planned for the three year mission and the schooner's value as a laboratory for life in space. Author

N92-32063# Naval Postgraduate School, Monterey, CA.

THE IMPACT OF COGNITIVE FEEDBACK ON THE PERFORMANCE OF INTELLIGENCE ANALYSTS M.S. Thesis

GERALDINE S. KROTOW Mar. 1992 74 p

(AD-A252176) Avail: CASI HC A04/MF A01

Human judgement and the process of decision making has been studied in depth for the past century. More recent research has revealed that feedback is a primary element in the decision making process. Feedback has been categorized according to its role in decision making. Some categories of feedback include cognitive, feedforward, and outcome. Cognitive feedback may hold the most promise for positively affecting the decision making

process. Naval Intelligence analysis is a complex process which involves human judgement and decision making on a daily basis. This thesis sought to determine whether or not cognitive feedback would enable intelligence analysts to make optimal choices more consistently than if they were presented with just outcome feedback. Naval Intelligence analysts were the subjects of an unclassified experiment which captured a realistic task performed routinely by analysts in the Fleet. The experiment revealed that cognitive feedback produced the most accurate and optimal results, and indicates that intelligence analysis would benefit from decision support systems that incorporate the element of cognitive feedback. GRA

N92-32105# California Univ., Santa Cruz. Dept. of Psychology and Psychobiology.

SPACE CONSTANCY ON VIDEO DISPLAY TERMINALS Annual Report, 1 Jan. - 31 Dec. 1991

BRUCE BRIDGEMAN 31 Dec. 1991 21 p

(Contract AF-AFOSR-0095-90)

(AD-A247290; AFOSR-92-0142TR) Avail: CASI HC A03/MF A01

Work for the grant's second year progressed in four projects. The first, a report of distorted space processing in flickering fields, concerns empirical work completed. The second project extended this work to high-speed flicker, at 480 and 960 Hz. No evidence was found that these high flicker rates have any advantages over slower rates, though some technical issues were resolved. The third project examined reading rates on CRT screens at 60 and 500 Hz. The faster rate resulted in reading that was on average 0.6 msec faster, a difference that is neither statistically reliable nor of practical consequence. Technical problems in that study were addressed in the fourth study, using more subjects and a larger and more difficult sample of reading material, with eye movement monitoring and an automatized screen refresh procedure. Initial results showed a small advantage in reading speed at the higher frequency for 4 to 6 subjects, and an overall advantage of 5 words/min at 500 Hz. Data collection is continuing in this project. GRA

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MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human engineering; biotechnology; and space suits and protective clothing.

A92-49270* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

SIMULATION EVALUATION OF A LOW-ALTITUDE HELICOPTER FLIGHT GUIDANCE SYSTEM ADAPTED FOR A HELMET-MOUNTED DISPLAY

HARRY N. SWENSON, RICHARD E. ZELENKA, GORDON H. HARDY, and MUNRO G. DEARING (NASA, Ames Research Center, Moffett Field, CA) IN: IEEE/AIAA Digital Avionics Systems Conference, 10th, Los Angeles, CA, Oct. 14-17, 1991, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1991, p. 115-124. refs

A computer aided concept for low-altitude helicopter flight has been developed and evaluated in a real-time piloted simulation. The concept included an optimal control trajectory-generation algorithm based upon dynamic programming, and a helmet-mounted display (HMD) presentation of a pathway-in-the-sky, a phantom aircraft, and flight-path vector/predictor guidance symbology. The pilot evaluation was conducted at the NASA-Ames Research Center moving base vertical motion simulator (VMS) by pilots representing NASA, the US Army, Air Force, and helicopter industry. The pilot manually tracked the trajectory generated by the algorithm utilizing the HMD symbology. The pilots were able to satisfactorily perform the

tracking tasks while maintaining a high degree of awareness of the outside world. I.E.

A92-49311

CREW SYSTEM ENGINEERING METHODOLOGY - PROCESS AND DISPLAY REQUIREMENTS

RICHARD S. MEJZAK, MATTHEW L. SPARTA, and NORMAN W. WARNER (U.S. Navy, Naval Air Development Center, Warminster, PA) IN: IEEE/AIAA Digital Avionics Systems Conference, 10th, Los Angeles, CA, Oct. 14-17, 1991, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1991, p. 387-392. refs

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The US Navy's Advanced Technology Crew Station (ATCS) Program was established to develop, demonstrate, and validate a crew systems engineering method that will achieve effective integration of aircrew and technologies within the aircraft system. The authors discuss the ATCS program, the crew systems engineering methodology and the derivation of display requirements within the methodology. The engineering methodology used approaches the aircraft design from the aircrew's perspective. One unique aspect of this methodology is that it provides traceability from mission-level requirements to aircraft-level system requirements to crew station requirements. One of the crew system requirements identified was the transfer of information from system to crew. Further analysis was required to define this requirement. The general approach used to derive information requirements is presented followed by a discussion of how the requirements were synthesized into viable display options. I.E.

A92-49320

A REAL-TIME APPROACH TO INFORMATION MANAGEMENT IN A PILOT'S ASSOCIATE

RONALD L. SMALL and CHARLES W. HOWARD (Search Technology, Inc., Atlanta, GA) IN: IEEE/AIAA Digital Avionics Systems Conference, 10th, Los Angeles, CA, Oct. 14-17, 1991, Proceedings. New York, Institute of Electrical and Electronics Engineers, Inc., 1991, p. 440-445. Research supported by USAF, Lockheed Corp., and Search Technology, Inc. refs

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A primary goal of the Pilot's Associate (PA) program is to enhance combat fighter pilot effectiveness by increasing a pilot's situational awareness and decreasing the workload. The Information Manager (IM) supports the pilot by intelligently presenting timely information in an easily interpreted form. The authors describe the requirements which a successful IM must fulfill. Among these are processing pilot display requests, reducing workload by configuring controls and displays automatically, alerting the pilot of pertinent events, and decluttering displays based on the pilot's current workload. In addition to these requirements, six constraints have been placed on the output of IM. IM's output must be timely and relevant, flexible and responsive, and predictable and intuitive. The constraints were addressed by the IM design. Search Technology's approach to providing information management in a real-time avionics environment is outlined. This approach has two main parts: the design and the real-time considerations of the design. I.E.

A92-49624

ELECTROLYSIS IN SPACE

UWE BENZ, HELMUT PREISS, and OTTMAR SCHMID Dornier Post (ISSN 0012-5563), no. 2, 1992, p. 27, 28.

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In future manned, long-term missions, such as the International Space Station, lunar and Mars missions, the supply of the vital substances oxygen and water is a central problem. The development of integrated closed loops, which reuse the major part of the substances, could solve this problem. Oxygen, for instance, could be reclaimed from carbon dioxide and water. Water from various sources (condensed water from cabin air, waste water, urine, etc.) could be cleaned without difficulty and would then be available again as drinking water or for other purposes. Author

A92-50011

INTEGRATED FLYING HELMETS

D. N. JARRETT and A. KARAVIS (Royal Aerospace Establishment, Farnborough, England) (Seminar on Man-Machine Interface in Civil and Military Aircraft, London, England, Oct. 10, 1991) Institution of Mechanical Engineers, Proceedings, Part G - Journal of Aerospace Engineering (ISSN 0954-4100), vol. 206, no. G1, 1992, p. 47-61. Research supported by Ministry of Defence Procurement Executive.

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The reasoning behind the requirement for an integrated approach to helmet design is reviewed with reference to some significant developments in helmet mounting equipment over the years. The technological areas are identified that are likely to provide the desired capabilities at much reduced weight, size, and power requirements. The discussion covers vision enhancement, helmet-mounted sights and displays, the miniature helmet-mounted low-light TV camera, eye aiming, and the virtual cockpit. The importance of a new design philosophy emphasizing functional integration rather than incorporation of compatible subsystems is demonstrated. V.L.

A92-50151* National Aeronautics and Space Administration, Washington, DC.

LIVING AND WORKING IN SPACE; IAA MAN IN SPACE SYMPOSIUM, 9TH, COLOGNE, FEDERAL REPUBLIC OF GERMANY, JUNE 17-21, 1991, SELECTION OF PAPERS

KARL E. KLEIN, ED. (DLR, Institut fuer Flugmedizin, Cologne, Federal Republic of Germany) and JEAN-MICHEL CONTANT, ED. (IAA; Aerospatiale, Les Mureaux, France) Symposium sponsored by CNES, ESA, and NASA. Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, 278 p. For individual items see A92-50152 to A92-50188.

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The present symposium on living and working in space encompasses the physiological responses of humans in space and biomedical support for the conditions associated with space travel. Specific physiological issues addressed include cerebral and sensorimotor functions, effects on the cardiovascular and respiratory system, musculoskeletal system, body fluid, hormones and electrolytes, and some orthostatic hypotension mechanisms as countermeasures. The biomedical support techniques examined include selection training, and care, teleoperation and artificial intelligence, robotic automation, bioregenerative life support, and toxic hazard risks in space habitats. Also addressed are determinants of orientation in microgravity, the hormonal control of body fluid metabolism, integrated human-machine intelligence in space machines, and material flow estimation in CELSS.

C.C.S.

A92-50179* National Aeronautics and Space Administration, Ames Research Center, Moffett Field, CA.

INTEGRATED HUMAN-MACHINE INTELLIGENCE IN SPACE SYSTEMS

GUY A. BOY (Sterling Federal Systems, Inc.; NASA, Ames Research Center, Moffett Field, CA) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 175-183. refs

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The integration of human and machine intelligence in space systems is outlined with respect to the contributions of artificial intelligence. The current state-of-the-art in intelligent assistant systems (IASs) is reviewed, and the requirements of some real-world applications of the technologies are discussed. A concept of integrated human-machine intelligence is examined in the contexts of: (1) interactive systems that tolerate human errors; (2) systems for the relief of workloads; and (3) interactive systems for solving problems in abnormal situations. Key issues in the development of IASs include the compatibility of the systems with astronauts in terms of inputs/outputs, processing, real-time AI,

and knowledge-based system validation. Real-world applications are suggested such as the diagnosis, planning, and control of engineered systems. C.C.S.

A92-50180**A SIMPLIFIED ECOSYSTEM BASED ON HIGHER PLANTS - ECOSIMP, A MODEL OF THE CARBON CYCLE**

M. ANDRE, L. CURNAC (CEA, Departement de Physiologie Vegetale et Ecosystemes, Saint-Paul-les-Durance, France), B. SAUGIER, and M. CALOIN (Paris XI, Universite, Orsay, France) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 189-196. refs

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A model of a simplified artificial ecosystem is proposed and examined as a model of plant-soil-atmosphere ecosystems for earth- and space-based research. The Ecosimp model is based on equations of the carbon cycle which can simulate the changes in atmospheric CO₂ and the carbon levels in plant material and a decomposer system. A parametric analysis is conducted to assess the effects of variations in photoperiod, rate of photosynthesis, biomass level in the decomposer, and decomposition kinetics. The simple analytical model shows that the CO₂ level in the ecosystem can be maintained without the use of CO₂ buffering techniques. The Ecosimp model is shown to be a practical tool for the evaluation of experimental parameters for large-scale ecosystems and for the prediction of the effects of CO₂ levels on local and global ecosystems. C.C.S.

A92-50181**MATERIAL FLOW ESTIMATION IN CELSS**

KEIJI NITTA (National Aerospace Laboratory, Chofu, Japan) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 205-210. refs

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The requirements of CELSS subsystems for a lunar base are evaluated with estimates of material flows required to support expected levels of human and plant life. The life-support functions to be installed in the habitat include initial-phase requirements for CO₂ elimination and O₂ recovery as well as operational-phase functions including water reclamation and nitrogen decomposition. Detailed flow estimates are given for water circulation, gas circulation, and plant physiological parameters, and flow charts detail the recycling systems assumed for the habitat, plant-cultivation, and plantation modules. Among the specific results are the assumptions of CO₂, N₂, and O₂ flows within and between the individual modules in grams/person per day. The results should be changed according to changing physical parameters of the lunar base, but the results are of use in the design of the modules and subsystem-flow parameters. C.C.S.

A92-50182**SOME CHALLENGES IN DESIGNING A LUNAR, MARTIAN, OR MICROGRAVITY CELSS**

FRANK B. SALISBURY (Utah State University, Logan) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 211-217. refs

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Theoretical and practical engineering considerations are reviewed as they relate to the design of a controlled ecological life-support system (CELSS) in space. Specific attention is given to the development of hardware and plants for the control of gas composition under microgravity, and the equipment for waste recycling is examined. Also encompassed are theoretical and software considerations such as the determination of cultivars, optimum growing conditions, and the achievement of long-term stability. Microgravity CELSS applications are shown to be the most problematic, while Martian or lunar CELSS do not present

such formidable obstacles. Critical breakthroughs in theory are required before many of the issues related to hardware can be solved. Examples of these breakthroughs include optimum environment and cultivation techniques, food-preparation methodologies, and protocols for waste recycling. C.C.S.

A92-50183**MICROBIAL AND HIGHER PLANT BIOMASS SELECTION FOR CLOSED ECOLOGICAL SYSTEMS**

CHRISTIAN TAMPONNET and ROGER A. BINOT (ESTEC, Noordwijk, Netherlands) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 219-230. refs

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The progressive recovery of food products from wastes in a CELSS system is studied theoretically to determine which microbes and higher plants would be required. The nutritional needs of a human crewmember on long-duration space missions are assessed, and a review is formulated of bacterial and higher-plant biomass production. These lead to a qualitative assessment of photosynthetic organisms for food production followed by three successive developments in theoretical food-delivery and -regeneration. The concepts are the production of some microbial food and or fresh food: (1) with experimental studies on higher plant production for Space Station application; (2) for applications to planetary missions and long-duration space missions; and (3) complete food production for planetary missions only. These three steps would enhance the effectiveness of long-duration space missions by reducing volume and mass needs for the spacecraft. C.C.S.

A92-50184**SPACE HABITAT CONTAMINANT GROWTH MODELS**

G. W. MORGENTHAUER, D. KOMPALA, G. J. SMITH, and T. MCADAMS (Colorado, University, Boulder) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 231-238. refs

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Contaminant growth models (CGMs) are discussed in terms of their relevance to the effective design of space habitats that mitigate the effects of contamination. A layered CGM approach is set forth in which a variety of contamination mechanisms, contaminants, and environment parameters can be introduced. The technique is based on a gradual layering of the CGM with continual module validation, and the two initial CGM layers are described. Some tools for contaminant analysis already exist and can be incorporated into the layered model such as NASA's Crew Health Environmental Control System. Areas of research for the development of a full model include thermodegradation, contaminant flow related to CELSS, particle toxicology and generation, contaminant identification, and microbial growth related to H₂O contaminants. C.C.S.

A92-50185* National Aeronautics and Space Administration, Washington, DC.

TOXICOLOGICAL IMPLICATIONS OF EXTENDED SPACE FLIGHTS

BERNARD WEISS, MARK UTELL, and PAUL MORROW (Rochester, University, NY) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 239-242. Research supported by NASA. refs

(Contract NIH-ES-01247)

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This paper draws attention to the needs and mechanisms for shielding crewmembers on long-duration space flights from hazards related to chemical toxicants. Specific attention is given to existing data on sources of impaired performance, namely, neurotoxicants,

respiratory infections, pulmonary function. The behavioral effects associated with long-term exposure to volatile organic solvents can impair crucial functional parameters of space flight and mission objectives. Respiratory infections contribute to performance decrements of up to 20 percent, and pulmonary function can be impaired by contaminants such as ozone leading to reduced performance. It is concluded that these and other sources of toxicologically induced performance reductions be studied since they impinge on vehicle design and mission objectives. C.C.S.

A92-50186

RISK CHARACTERIZATION AND THE EXTENDED SPACEFLIGHT ENVIRONMENT

RICHARD D. IRONS (Colorado, University, Denver), RALPH EBERHARDT, and JON SCHULZ (Martin Marietta Astronautics Group, Denver, CO) (Living and working in space; IAA Man in Space Symposium, 9th, Cologne, Federal Republic of Germany, June 17-21, 1991, Selection of Papers. A92-50151 21-54) Acta Astronautica (ISSN 0094-5765), vol. 27, July 1992, p. 243-250. refs

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The prediction and modeling of contaminant-induced toxicity and performance degradation are discussed as they relate to long-duration space flight. Risk characterization is considered in the light of physical and environmental factors, combustion toxicity, external contamination by hydrazine, and radiation toxification. Also examined are: (1) the control of microflora in a CELSS environment; (2) changes in physiological susceptibility to toxicity due to space travel; (3) the influence of body-fluid redistribution and cephalic fluid shifts on the blood-brain barrier and pharmacokinetics; and (4) the influences of microgravity and stress on the blood and immune systems. Risk characterization is concluded to require an integration of exposure concentration vs time to derive spacecraft maximum allowable concentrations (SMACs). A fractional response model is shown to permit probabilistic criteria for adverse outcomes as opposed to the deterministic assessments afforded by SMACs. C.C.S.

A92-50240

WIND TUNNEL TEST OF UPPER ARM OF AN EJECTION CREWMAN AND EJECTION SEAT AT TRANSONIC-SUPERSONIC SPEED

GUI-RONG WU and YUN-RAN ZHANG (Beijing Institute of Space Medico-Engineering, People's Republic of China) Chinese Journal of Aeronautics (ISSN 1000-9361), vol. 5, no. 2, May 1992, p. 137-142. refs

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The results of wind tunnel tests of the upper arm of a 1/10 scale model crewman and ejection seat at transonic-supersonic speed are presented in this paper. Drag and side forces on the upper arm were measured at freestream with Mach number from 0.5 to 2.04 and pitch angle from 10 deg to 20 deg. The aerodynamic characteristics of the upper arm in the configurations of hands on top of thighs and alternate firing handle were obtained. Aerodynamic data on upper arm were compared under the conditions with and without cloth. This paper presents the important aerodynamic data for determining tolerance of the human upper arm to windblast and designing an aircrew windblast protective device. Author

A92-50282

CARDIOVASCULAR RESPONSES TO POSITIVE PRESSURE BREATHING USING THE TACTICAL LIFE SUPPORT SYSTEM

LEONARD S. GOODMAN, WILLIAM D. FRASER, DAVID E. EASTMAN, and KENNETH N. ACKLES (Defence and Civil Institute of Environmental Medicine, North York, Canada) Aviation, Space, and Environmental Medicine (ISSN 0095-6562), vol. 63, no. 8, Aug. 1992, p. 662-669. refs

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The improved protection afforded by the Tactical Life Support System (TLSS) vs other partial pressure ensembles has not been reported with respect to the cardiovascular effects of positive pressure breathing (PPB). Nine seated subjects wearing TLSS were

exposed to 30, 50, and 70 mm Hg PPB (breathing air) with four times this pressure in the G-suit. Stroke volume and cardiac output (SV, CO) and indexes (SI, CI) were determined by impedance cardiography. Mean arterial pressure (MAP) was directly related to PPB level, increasing by 23, 32, and 47 percent for each PPB level, respectively. HR, SV, and CO were unaffected after 4 min of 30, 50, and 70 mm Hg PPB. The results indicate that cardiovascular function decay is less severe than that reported using other PPB ensembles at similar PPB levels. Improved protection is most likely due to the greater pressurization of the G-suit and the 45 percent greater bladder volume in the leg bladders, leading to restored venous return and SV. Author

A92-51632

CANEX-2 SPACE VISION SYSTEM EXPERIMENTS FOR SHUTTLE FLIGHT STS-54

H. F. L. PINKNEY, C. I. PERRATT (National Aeronautical Establishment, Ottawa, Canada), and S. G. MACLEAN (Canadian Space Agency, Canadian Astronaut Program Office, Vanier, Canada) IN: Close-range photogrammetry meets machine vision; Proceedings of the Meeting, Zurich, Switzerland, Sept. 3-7, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1990, p. 374-381. refs

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The Canadian-developed Space Vision System (SVS) to be flown by STS-54 makes possible a series of Shuttle Orbiter-based Remote Manipulator System tasks in the weightless/thermal/illumination environment typical of space by means of real-time guidance information. Attention is given to (1) the basic multiprocessor architecture of the SVS, (2) the photogrammetric algorithm-defined multiple target array payload and targeted berthing hardware, and (3) the preflight camera calibration setup procedures, and the on-orbit reference calibration procedures for task-related coordinate transformations for thermally charging Shuttle-Remote Manipulator System deformations. O.C.

A92-51701

COOPERATIVE INTELLIGENT ROBOTICS IN SPACE; PROCEEDINGS OF THE MEETING, BOSTON, MA, NOV. 6, 7, 1990

RUI J. DEFIGUEIREDO, ED. (California, University, Irvine) and WILLIAM E. STONEY, ED. (Mitre Corp., McLean, VA) Meeting sponsored by SPIE. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers (SPIE Proceedings. Vol. 1387), 1991, 417 p. For individual items see A92-51702 to A92-51735. (SPIE-1387; ISBN 0-8194-0454-3) Copyright

The papers presented in this volume focus on plans, requirements, and concepts for use of robotics in space as well as current research and development efforts pertaining to integrated sensor-based robot automation technology, human control of automated robotic operations, and applications of advanced industrial robotics to space operations. Topics discussed include experiments in robotic assembly of truss structures in space, large-scale space systems, and space roles for robots and human-robot systems. Other topics are robot control technology, machine vision, telerobotics, and motion estimation/control from sensing. V.L.

A92-51708

SPACE ROLES FOR ROBOTS

RODGER A. CLIFF (Lockheed Research Laboratories, Palo Alto, CA) IN: Cooperative intelligent robotics in space; Proceedings of the Meeting, Boston, MA, Nov. 6, 7, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1991, p. 98-100. Copyright

The concept of a robotic system is defined, and some engineering issues involved in the use of robots in space are briefly examined. Several space applications for robots are discussed, including inspection, servicing, maintenance, and repair of various artifacts. The use of in situ extraterrestrial materials for the construction of space robots is also briefly discussed. V.L.

A92-51711

ACHIEVING A BALANCE BETWEEN AUTONOMY AND TELEOPERATION IN SPECIFYING PLANS FOR A PLANETARY ROVER

DAMIAN M. LYONS (North American Philips Corp., Autonomous Systems Dept., Briarcliff, NY) and JUDITH H. ALLTON (Lockheed Engineering and Sciences Co., Houston, TX) IN: Cooperative intelligent robotics in space; Proceedings of the Meeting, Boston, MA, Nov. 6, 7, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1991, p. 124-133. refs

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The issue of a correct balance of autonomy and teleoperation for a planetary rover is examined from the standpoint of utility to the human user rather than simply hazard avoidance. The approach adopted here is to design a graphical interface for rover commands and feedback to maximize the user identification with the rover. The interface will translate advice from the user into plan networks which will then be sent to the rover. Plan networks and translation are represented using the RS model, a special model of distributed computation designed for representing and analyzing plans for autonomous systems. A 'pencil and paper' example of using the interface for cooperative exploration in an unknown area is presented.

V.L.

A92-51719

DESIGN AND TESTING OF A NON-REACTIVE, FINGERTIP, TACTILE DISPLAY FOR INTERACTION WITH REMOTE ENVIRONMENTS

NICHOLAS J. M. PATRICK, THOMAS B. SHERIDAN, MICHAEL J. MASSIMINO (MIT, Cambridge, MA), and BETH A. MARCUS (Exos, Inc., Burlington, MA) IN: Cooperative intelligent robotics in space; Proceedings of the Meeting, Boston, MA, Nov. 6, 7, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1991, p. 215-222. refs

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The objective of the study was to design and demonstrate a tactile feedback system as an inexpensive alternative to the reactive force feedback and to determine the extent to which such a system could aid in the performance of a simple teleoperation task. The final design consists of two voice coils, one each for the thumb and the index finger, which are driven by a 250-Hz variable-amplitude signal produced by a microcomputer-controlled analog electronic unit. It is shown experimentally that the addition of the tactile display provides a slight improvement in manual tracking performance over the use of the visual display alone. However, when used alone, the tactile feedback allows a significant level of task performance, making it particularly useful in situations where the visual feedback may be interrupted or degraded.

V.L.

A92-51727

DESIGN AND CONTROL OF ULTRALIGHT MANIPULATORS FOR INTERPLANETARY EXPLORATION

ERIC BYLER (Martin Marietta, Corp., Denver, CO) IN: Cooperative intelligent robotics in space; Proceedings of the Meeting, Boston, MA, Nov. 6, 7, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1991, p. 313-327. refs

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Design and construction of an extremely lightweight manipulator is discussed. This 3 m, 4 kg arm can manipulate a payload of 20N, half its weight on earth and almost twice its weight on Mars. Limited manipulator performance resulting from design constraints requires innovative control techniques. These include flexible control (for the nonstiff structure), endpoint control (for the compliant mechanisms), and arm/vehicle cooperation (for dynamic interactions and limited payload capability). Synergistic use of sensors and planners between the two semiautonomous arm and vehicle systems is discussed as it affected prototype design. Use of the NASREM standard functional architecture improved system integration and allows installation on both the wheeled and walking rovers.

Author

A92-51729*

Jet Propulsion Lab., California Inst. of Tech., Pasadena.

OPERATOR-COACHED MACHINE VISION FOR SPACE Telerobotics

BRUCE BON, BRIAN WILCOX, TODD LITWIN, and DONALD B. GENNERY (JPL, Pasadena, CA) IN: Cooperative intelligent robotics in space; Proceedings of the Meeting, Boston, MA, Nov. 6, 7, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1991, p. 337-342. refs

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A prototype system for interactive object modeling has been developed and tested. The goal of this effort has been to create a system which would demonstrate the feasibility of high interactive operator-coached machine vision in a realistic task environment, and to provide a testbed for experimentation with various modes of operator interaction. The purpose for such a system is to use human perception where machine vision is difficult, i.e., to segment the scene into objects and to designate their features, and to use machine vision to overcome limitations of human perception, i.e., for accurate measurement of object geometry. The system captures and displays video images from a number of cameras, allows the operator to designate a polyhedral object one edge at a time by moving a 3-D cursor within these images, performs a least-squares fit of the designated edges to edge data detected with a modified Sobel operator, and combines the edges thus detected to form a wire-frame object model that matches the Sobel data.

Author

A92-51730

TEST OF A VISION-BASED AUTONOMOUS SPACE STATION ROBOTIC TASK

ANTHONY R. CASTELLANO, VINCENT S. HWANG, and W. E. STONEY (Mitre Corp., McLean, VA) IN: Cooperative intelligent robotics in space; Proceedings of the Meeting, Boston, MA, Nov. 6, 7, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1991, p. 343-350. refs

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Current research related to the use of situated control for the autonomous robotic assembly of Orbital Replacement Units (ORUs) is reviewed. A wrist-mounted camera is used to acquire the 3D pose (position and orientation) of a workpiece. An on-line control module uses the pose data to refine the ongoing robot actions so that the planned task can be executed both safely and robustly. The system has been tested using an industrial robot with a wrist-mounted CCD camera. Preliminary results of the tests are reported.

V.L.

A92-51731

SITUATION ASSESSMENT FOR SPACE Telerobotics

GUY BRUNO and MATTHEW K. MORGENTHAUER (Martin Marietta Space Systems, Denver, CO) IN: Cooperative intelligent robotics in space; Proceedings of the Meeting, Boston, MA, Nov. 6, 7, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1991, p. 352-358. refs

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A hierarchical approach to a system for telerobotic situation assessment is presented whereby teleoperator action interpretations are automatically generated in terms of geometric model updates. At the lowest levels, high frequency data are interpreted in very general terms. As situation assessment progresses to higher levels of abstraction, more specific hypotheses are generated about time intervals of longer duration. The general design of a Telerobotic Situation Assessment system to be used in conjunction with a teleautonomous testbed is described.

V.L.

A92-51732*

National Aeronautics and Space Administration, Washington, DC.

TELEROBOTIC CAPABILITIES FOR SPACE OPERATIONS

DAVID L. AKIN (Maryland, University College Park) IN: Cooperative intelligent robotics in space; Proceedings of the Meeting, Boston, MA, Nov. 6, 7, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1991, p. 359-364. refs

(Contract NAGW-21; NAGW-2245)

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This paper presents a summary of tests involving either pure telerobotics, or telerobots in conjunction with extravehicular activity, applied to some of the servicing tasks of the Hubble Space Telescope (HST). This research was conducted in a neutral buoyancy environment, using the high fidelity mockup used for astronaut crew training, along with two telerobots developed in the Space Systems Laboratory. These tests showed that current telerobots are capable of a limited subset of tasks required for EVA servicing of HST, and that specific developments in robotic capability are required, particularly in high torque output and positioning in constrained volumes, before the telerobotic systems are capable replacements to EVA. A more immediately promising application is the use of telerobots to enhance and extend the EVA capabilities, by acting as 'assistants' to the EVA crewmen performing the dexterous and high-force tasks. Author

A92-51733* Jet Propulsion Lab., California Inst. of Tech., Pasadena.

ROLE OF COMPUTER GRAPHICS IN SPACE TELEROBOTICS - PREVIEW AND PREDICTIVE DISPLAYS

ANTAL K. BEJCZY, STEVEN VENEMA, and WON S. KIM (JPL, Pasadena, CA) IN: Cooperative intelligent robotics in space; Proceedings of the Meeting, Boston, MA, Nov. 6, 7, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1991, p. 365-377. refs

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The application of computer graphics in space telerobotics research and development work is briefly reviewed and illustrated by specific examples implemented in real time operation. The applications are discussed under the following four major categories: preview displays, predictive displays, sensor data displays, and control system status displays. V.L.

A92-51734

OPTICAL TARGET LOCATION USING MACHINE VISION IN SPACE ROBOTICS TASKS

CHERYL SKLAIR, LANCE CATRELL, WILLIAM HOFF (Martin Marietta Space Systems, Denver, CO), and MICHAEL MAGEE (Wyoming University, Laramie) IN: Cooperative intelligent robotics in space; Proceedings of the Meeting, Boston, MA, Nov. 6, 7, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1991, p. 380-391. refs

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For practical use of robotics in space, machine vision is required to automatically locate objects in order to guide an autonomous control system or to assist a human teleoperator. The vision task is facilitated by placing optical targets or markings in advance on the objects to be located. Techniques to locate such optical targets from monocular images were investigated experimentally. These include camera calibration, determination of the camera to tool endpoint transformation, feature extraction, and pose estimation. This paper describes experiences with these techniques as they were implemented in an integrated robot-vision system to perform tasks characteristic of space construction and servicing. Accuracies of the target location techniques were also verified separately using an optical bench and positioning devices. Author

A92-51735* National Aeronautics and Space Administration. Lyndon B. Johnson Space Center, Houston, TX.

IMPLEMENTATION AND CONTROL OF A 3 DEGREE-OF-FREEDOM FORCE-REFLECTING MANUAL CONTROLLER

WHEE K. KIM (Texas University, Austin), PAT BEVILL (McDonnell Douglas Space Systems Co., Huntington Beach, CA), and DELBERT TESAR (Texas University, Austin) IN: Cooperative intelligent robotics in space; Proceedings of the Meeting, Boston, MA, Nov. 6, 7, 1990. Bellingham, WA, Society of Photo-Optical Instrumentation Engineers, 1991, p. 392-406. refs

(Contract NAG9-320; DE-FG02-86NE-37966)

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An implementation of a manual controller system is described in which a parallel 3-DOF spherical structure (for compactness and reduced weight) is combined with high-gear-ratio reducers

using a force control algorithm to produce a 'power steering' effect for enhanced smoothness and transparency. The force control algorithm has the further benefit of minimizing the effect of the system friction and nonlinear inertia forces. The required analyses for a universal force-reflecting manual controller application are presented, as are test results for a prototype system. V.L.

A92-51996

DYNAMIC ANALYSIS TO EVALUATE VISCOELASTIC PASSIVE DAMPING AUGMENTATION FOR THE SPACE SHUTTLE REMOTE MANIPULATOR SYSTEM

THOMAS E. ALBERTS, HOUGHUN XIA, and YUNG CHEN (Old Dominion University, Norfolk, VA) IN: Advances in dynamics and control of flexible spacecraft and space-based manipulations; Proceedings of the Symposium, ASME Winter Annual Meeting, Dallas, TX, Nov. 25-30, 1990. New York, American Society of Mechanical Engineers, 1990, p. 35-41. refs

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A NASTRAN finite element analysis was used to evaluate the effectiveness of viscoelastic passive damping augmentation to active control for large flexible space manipulators. The vibrational properties of each of structural member and each mode of the complex flexible chained system were studied using modal potential energy analysis. It was found that two categories of the most dominant contributors to end-point oscillations, namely, very low frequency modes due to joint flexibility and higher frequency modes due to bending in the booms, result in significant end-point motions. A finite element analysis is used to evaluate the effectiveness of constrained viscoelastic layer damping treatments for passive vibration control. It is shown that even the joint compliance dominated modes can be damped to some degree through appropriate design of the treatment. O.G.

A92-52432* # National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

HELMET MOUNTED DISPLAY FLIGHT SYMBOLOGY RESEARCH

LORAN A. HAWORTH and RONALD E. SEERY (U.S. Army, Aeroflightdynamics Directorate; NASA, Ames Research Center, Moffett Field, CA) IN: AIAA/AHS Flight Simulation Technologies Conference, Hilton Head Island, SC, Aug. 24-26, 1992, Technical Papers. Washington, American Institute of Aeronautics and Astronautics, 1992, p. 37-56. refs

(AIAA PAPER 92-4137)

Screen/head stabilized MIL-STD 1295 helmet mounted display (HMD) flight symbology as integrated on the Apache helicopter was compared to world referenced/stabilized flight symbology. Simulation test results indicate that pilots perform significantly better using world-stabilized conformal attitude symbology. They were accurate to an average of 1/2 degree at estimating terrain relief and aerial target locations. World stabilized conformal symbology was preferred while performing contour flight tasks. They reported that the use of climb-dive-marker during contour flight greatly reduced pilot work load under conditions tested. Cyclic input errors occurred when using both 1295 hover symbology and test symbology indicating that a better approach for depicting hover symbology is warranted. The magnitude of cyclic input and spatial estimation errors increased as the off-axis viewing angle became larger. Author

A92-52453#

AN ELECTRONIC VISUAL DISPLAY ATTITUDE SENSOR (EVDAS) FOR ANALYSIS OF FLIGHT SIMULATOR DELAYS

GARY J. SLUTZ (Electronic Associates, Inc., Wright-Patterson AFB, OH) and RONALD B. EWART (USAF, Wright Laboratory, Wright-Patterson AFB, OH) IN: AIAA/AHS Flight Simulation Technologies Conference, Hilton Head Island, SC, Aug. 24-26, 1992, Technical Papers. Washington, American Institute of Aeronautics and Astronautics, 1992, p. 253-260. refs

(AIAA PAPER 92-4167)

This paper discusses a new approach for the measurement of visual system time delays for flight simulators. The approach involves the use of an electronic circuit which monitors the video

in raster format going into the pilot's display subsystem. The circuit measures the horizon's pitch and roll angles and outputs the information so that it can be used for time delay analysis. Time delay measurement techniques are reviewed and several practical applications are discussed. Experimental data for an existing simulation and techniques for minimizing delays based upon the results are discussed. Author

A92-52526* National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

TECHNIQUES AND APPLICATIONS FOR BINAURAL SOUND MANIPULATION IN HUMAN-MACHINE INTERFACES

DURAND R. BEGAULT and ELIZABETH M. WENZEL (NASA, Ames Research Center, Moffett Field, CA) International Journal of Aviation Psychology (ISSN 1050-8414), vol. 2, no. 1, 1992, p. 1-22. Previously announced in STAR as N90-28996. refs Copyright

The implementation of binaural sound to speech and auditory sound cues (auditory icons) is addressed from both an applications and technical standpoint. Techniques overviewed include processing by means of filtering with head-related transfer functions. Application to advanced cockpit human interface systems is discussed, although the techniques are extendable to any human-machine interface. Research issues pertaining to three-dimensional sound displays under investigation at the Aerospace Human Factors Division at NASA Ames Research Center are described. Author

N92-30381*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, AL.

ASSESSMENT OF A HEAD-MOUNTED MINIATURE MONITOR Final Report

J. P. HALE, II Jun. 1992 32 p
(Contract PROJ. 89-07)

(NASA-TM-103587; NAS 1.15:103587) Avail: CASI HC A03/MF A01

Two experiments were conducted to assess the capabilities and limitations of the Private Eye, a miniature, head-mounted monitor. The first experiment compared the Private Eye with a cathode ray tube (CRT) and hard copy in both a constrained and unconstrained work envelope. The task was a simulated maintenance and assembly task that required frequent reference to the displayed information. A main effect of presentation media indicated faster placement times using the CRT as compared with hard copy. There were no significant differences between the Private Eye and either the CRT or hard copy for identification, placement, or total task times. The goal of the second experiment was to determine the effects of various local visual parameters on the ability of the user to accurately perceive the information of the Private Eye. The task was an interactive video game. No significant performance differences were found under either bright or dark ambient illumination environments nor with either visually simple or complex task backgrounds. Glare reflected off of the bezel surrounding the monitor did degrade performance. It was concluded that this head-mounted, miniature monitor could serve a useful role for in situ operations, especially in microgravity environments. Author

N92-30592# Aeronautical Systems Div., Wright-Patterson AFB, OH.

KC-135 CREW REDUCTION FEASIBILITY DEMONSTRATION SIMULATION STUDY. VOLUME 1: FUNCTION ANALYSIS AND FUNCTION REALLOCATION Final Report, Oct. 1990 - Jan. 1991

G. F. WARD, ROSS A. DUDLEY, JOHN A. HASSOUN, EDWARD R. HUGHES, and JUSTIN D. RUEB Jun. 1991 123 p
(AD-A252265; ASD-TR-91-5005-VOL-1) Avail: CASI HC A06/MF A01

A function analysis of the four-person crew KC-135 and function reallocation to a three-person crew were completed in support of the KC-135 Avionics Modernization Program. This report is volume one of a three-volume technical report. This effort provided a distribution of functions between automation concepts and the

remaining three crewmembers. The function redistribution and automation concepts served as a baseline for a crew station design group to design a cockpit configuration for a three-person crew KC-135 (Vol 2). This configuration was then implemented in a simulator at the Crew Station Evaluation Facility (CSEF) for a comprehensive man-in-the-loop simulation evaluation (Vol 3). The function analysis and reallocation were the first step towards modifying the KC-135 cockpit and will be instrumental in future KC-135 efforts. GRA

N92-30615# Naval Research Lab., Washington, DC.

EYE/SENSOR PROTECTION AGAINST LASER IRRADIATION

ABLATIVE MIRROR DEVICES: A MATERIALS ASSESSMENT

MICHAEL E. BOYLE, ROBERT F. COZZENS, and DOUGLAS B. CHRISEY 17 Apr. 1992 50 p
(AD-A248787; NRL/MR/4440-92-6964) Avail: CASI HC A03/MF A01

The potential of the ablative mirror concept as an eye/sensor protection system is assessed from a materials science perspective. Realistic operating parameters for the ablative mirror device are determined through examinations of the critical device components. Using these operational parameters and a derived model of laser-surface interactions, the response of different mirror materials is examined. Based on the measured material responses from research literature and our calculated values, we conclude that the ablative mirror concept is not a feasible method of eye protection using typical mirror materials (assuming a device optical gain of 105 and a minimum material reflectivity of 70 percent). Analysis of the interaction between laser irradiation and material surfaces resulted in the identification of a number of important material parameters that can be used to guide material development and identify promising new mirror materials. Areas for future research are also suggested. GRA

N92-30718# Naval Postgraduate School, Monterey, CA.

INTRODUCTION TO HUMAN FACTORS AND WIDE AREA NETWORKING M.S. Thesis

JOHN G. CLARKE Mar. 1992 122 p
(AD-A252310) Avail: CASI HC A06/MF A02

The Human-Systems Interaction Course taught at the Naval Postgraduate School is an introduction to the human-systems interface, that part of the system which the human uses to provide input to and receive feedback from the system. This thesis will provide a basic introduction to those which must be considered when designing today's complex military systems. Additionally, this thesis will provide an introduction to the Internet - a worldwide network of computers and smaller networks. Students will use the Internet to gather information, access remote programs, and communicate with other personnel around the world. This is only an introduction to both of these complex topics. GRA

N92-30844# Biodynamic Research Corp., San Antonio, TX.

ADAPTING THE ADAM MANIKIN TECHNOLOGY FOR INJURY PROBABILITY ASSESSMENT Final Report, 5 Jul. 1991 - 19 Feb. 1992

J. H. RADDIN, JR., W. R. SCOTT, J. B. BOMAR, H. L. SMITH, and J. V. BENEDICT 19 Feb. 1992 251 p
(Contract F41624-91-C-6003)

(AD-A252332; AL-TR-1992-0062) Avail: CASI HC A12/MF A03

An approach is presented for the general definition of regional injury human impact criteria with particular attention to the articulated ADAM test manikin and the escape environment. A review of literature and ejection injury data confirmed that injuries of greatest interest were those to the head, neck, thoracolumbar spine, and proximal extremities. A substantial literature review was pursued, demonstrating consistent findings of strain rate-dependent injury behavior over a wide range of injury types and body regions. Building upon previous work on the Dynamic Response Index, a comprehensive proposal is advanced for the conceptual definition of regional viscoelastic strain models for injury probability assessment. The proposed form for a head injury criterion assesses both translation and angular acceleration stress in terms of viscoelastic strain while also incorporating a means to account for

their interaction. The neck criterion is based on a viscoelastic strain model of axial stress in association with shear and moment effects. The thoracolumbar spine criterion also proposes an extension of the prior DRI approach to account for interacting effects of moments and shear stresses. Approaches for the proximal extremities are formulated in a similar fashion. An outline is proposed for quantitative formulation and validation of the concept. GRA

N92-31166*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, CA.

WASTE STREAMS IN A TYPICAL CREWED SPACE HABITAT: AN UPDATE

M. A. GOLUB and T. WYDEVEN Feb. 1992 15 p
(Contract RTOP 591-34-31)
(NASA-TM-103888; A-91224; NAS 1.15:103888) Avail: CASI HC A03/MF A01

A compilation of generation rates and chemical compositions of potential waste streams in a typical crewed space habitat, reported in a prior NASA Technical Memorandum and a related journal article, was updated. This report augments that compilation by the inclusion of the following new data: those data uncovered since completion of the prior report; those obtained from Soviet literature relevant to life support issues; and those for various minor human body wastes not presented previously (saliva, flatus, hair, finger- and toenails, dried skin and skin secretions, tears, and semen), but included here for purposes of completeness. These waste streams complement those discussed previously: toilet waste (urine, feces, etc.), hygiene water (laundry, shower/handwash, dishwasher water and cleansing agents), trash, humidity condensate, perspiration and respiration water, trace contaminants, and dust generation. This report also reproduces the latest information on the environmental control and life support system design parameters for Space Station Freedom. Author

N92-31294# Army Research Inst. for the Behavioral and Social Sciences, Alexandria, VA.

EMPIRICAL DEVELOPMENT OF A SCALE FOR THE PREDICTION OF PERFORMANCE ON A SUSTAINED MONITORING TASK Final Report, Jun. 1991 - Jan. 1992

LINDA G. PIERCE and LLOYD M. CRUMLEY May 1992 28 p
(AD-A252443; ARI-RN-92-36) Avail: CASI HC A03/MF A01

Research on vigilance performance has been extensive, but few guidelines exist for selecting persons well suited to perform vigilance tasks. The focus of this pilot study was to determine if a subset of items from the Minnesota Multiphasic Personality Inventory (MMPI) that would discriminate between soldiers able to sustain an adequate level of performance and soldiers whose performance deteriorated over time could be identified. Thirty-nine items produced chi-squares with p values less than .05. A discriminant analysis correctly classified 88.5 percent of the soldiers maintaining their performance rate and 83.9 percent of the soldiers with performance degraded over time. If validation efforts are successful, it may be possible to use the 39-item scale to select soldiers who will, on average, detect 13 percent more targets and incorrectly identify 15 percent fewer targets. GRA

N92-31309# Midwest Research Inst., Golden, CO.
SIMPLIFIED AIR CHANGE EFFECTIVENESS MODELING

B. A. ROCK, R. ANDERSON, and M. J. BRANDEMUEHL (Colorado Univ., Boulder.) Jun. 1992 23 p
(Contract DE-AC02-83CH-10093)
(DE92-010577; NREL/TP-432-4737) Avail: CASI HC A03/MF A01

This paper describes recent progress in developing practical air change effectiveness modeling techniques for the design and analysis of air diffusion in occupied rooms. The ultimate goal of this continuing work is to develop a simple and reliable method for determining heating, ventilating, and air-conditioning (HVAC) system compliance with ventilation standards. In the current work, simplified two-region models of rooms are used with six occupancy patterns to find the air change effectiveness. A new measure, the apparent ACH effectiveness, yields the relative ventilation

performance of an air diffusion system. This measure can be used for the prediction or evaluation of outside air delivery to the occupants. The required outside air can be greater or less than that specified by ventilation standards such as ASHRAE Standard 62-89. DOE

N92-31327# Naval Health Research Center, San Diego, CA.
STRESS REACTIVITY: FIVE-FACTOR REPRESENTATION OF A PSYCHOBIOLOGICAL TYPOLOGY Interim Report, Mar. - Aug. 1991

ROSS R. VICKERS, JR. 26 Aug. 1991 37 p
(Contract NR PROJ. MR0-4101)
(AD-A252715; NHRC-91-26) Avail: CASI HC A03/MF A01

A typology contrasting stress reactive individuals with stress resistant individuals has been proposed based on studies of children and nonhuman primates. The present study tested for these hypothesized types in U.S. Navy recruits who completed the NEO Personality Inventory. Hierarchical agglomerative and partitioning cluster analyses were conducted in 10 samples of U.S. Navy recruits ($n = 331-335$). Replicability of clusters across subsamples was a primary criterion for choosing between alternative cluster solutions. Applying this criterion, up to five clusters could be identified reliably. The five-factor personality profiles for two types in the five-cluster solution approximated a priori predictions about reactive and resistant profiles well enough to indicate that a reactivity typology is a viable model of personality differences in this population. GRA

N92-31330# Minnesota Univ., Minneapolis. Dept. of Psychology.
HUMAN IMAGE UNDERSTANDING Final Report, 1 Jun. 1988 - 1 Jan. 1992

IRVING BIEDERMAN 17 Apr. 1992 27 p
(Contract AF-AFOSR-0231-88)
(AD-A250401; AFOSR-92-0360TR) Avail: CASI HC A03/MF A01

An extensive series of experiments assessing the visual priming of briefly presented images indicates that the visual representation that mediates real-time object recognition specifies neither the image edges or vertices nor an overall model of the object but an arrangement of simple volumes (or geons) corresponding to the object's parts. This representation can be activated with no loss in efficiency when the image is projected onto the retina at another position, size, or orientation in depth from when originally viewed. Consideration of these invariances suggests a computational basis for the evolution of two extrastriate visual systems, one for recognition and the other subserving motor interaction. It may be possible to assess the functioning of these systems behaviorally, that is, to split the cortex horizontally, through a comparison of performance on naming and episodic memory tasks. We have developed a neural network model that captures the essential characteristics of human object recognition performance. GRA

N92-31458# Aerospace Medical Research Labs., Wright-Patterson AFB, OH.

VERTICAL IMPACT TESTS OF HUMANS AND ANTHROPOMORPHIC MANIKINS Interim Report, 28 Sep. 1987 - 19 Apr. 1991

JOHN R. BUHRMAN Apr. 1991 147 p
(Contract AF PROJ. 7231)
(AD-A245866; AL-TR-1991-0129) Avail: CASI HC A07/MF A02

Small and large prototype Advanced Dynamic Anthropomorphic Manikins (ADAM's) along with CG-95 and CG-95 GARD manikins, were subjected to impacts up to +24 Gz on a vertical deceleration tower. Human subjects were also tested at levels of up to +10 Gz. The test variables were acceleration input and rise-time, seat-back angle, restraint harness, and seat cushion. Both the small and large ADAM's were found to be structurally sound at test up to +24 Gz. Data acquisition, however, was often incomplete, due mostly to broken wires, noisy channels, and circuit board failures. Both ADAM manikins demonstrated reasonable good repeatability of acceleration and force data in the direction of impact, although the channel sensitivities appeared to gradually change with repeated tests. The small ADAM appeared to

demonstrate relatively consistent simulation of human dynamic response in the z-axis, but the large ADAM had a tendency to generate larger peak acceleration and seat force data than expected. Employing a Confor(TM) Foam seat cushion appeared to have almost no effect on human dynamic response. The X-Band 90 deg restraint harness appeared to outperform the PCU-15/P harness in the human tests. Varying the seat-back angle + or - 10 degree significantly effected only the peak magnitude of the x-axis chest acceleration data. GRA

N92-31974# University of Central Florida, Orlando. Inst. for Simulation and Training.

HEAD TRACKING AND HEAD MOUNTED DISPLAYS FOR TRAINING SIMULATIONS Report, 1990 - 1992

J. M. MOSHELL, RICHARD DUNN-ROBERTS, and PAT MOSKAL
5 Feb. 1992 168 p
(Contract N61339-90-C-0041)
(AD-A250866; IST-TR-92-12) Avail: CASI HC A08/MF A02

A two part task is presented. The first task constructs a six monitor display around a Simulated Abrams M1A1 Tank Commander location. The scene is simultaneously displayed on three monitors. The scene switches to the adjacent three monitors as a function of the Tank Commander's head motion. Production simulator difficulties were studied. The second task integrates 'eye phones' and CyberFace to various image generators, especially ESIG500 and SIMNET IG. Simulation usefulness issues were researched. GRA

N92-32019 Alenia Spazio S.p.A., Turin (Italy).

ITALIAN-US COOPERATION IN SPACE: THE CASE OF TETHERED, IRIS/LAGEOS, AND SPACEHAB

PAOLO PIANTELLA /In Huntsville Association of Technical Societies, TABES 92: 8th Annual Technical and Business Exhibition and Symposium. Executive Summaries and Submitted Papers 21 p 1992

(TABES PAPER 92-467) Copyright Avail: Issuing Activity

Cooperation between the U.S. and Italy is discussed in three space missions: (1) the Tethered Satellite System; (2) the Italian Research Interim Stage (IRIS) launcher and Laser Geodynamic Satellite (LAGEOS) satellite; and (3) the SPACEHAB modules. Each of these programs is described in detail, including: project overview; instrumentation; objectives; and international cooperation to achieve goals. H.A.

N92-32023# Institute for Defense Analyses, Alexandria, VA.
PILOT ERRORS INVOLVING HEAD-UP DISPLAYS (HUDS), HELMET-MOUNTED DISPLAYS (HMDS), AND NIGHT VISION GOGGLES (NVGS) Final Report, Jun. - Nov. 1991

LUCIEN M. BIBERMAN and EARL A. ALLUISI Jan. 1992 166 p

(AD-A250719; IDA-P-2638; IDA/HQ-91-40259; AD-E501523)
Avail: CASI HC A08/MF A02

Having become aware of difficulties with night vision and display equipment in helicopters and fixed-wing aircraft, IDA staff members collected pertinent literature, interviewed aircrews, aeromedical research people, and cockpit designers, and then carried out display simulations. They found serious safety problems associated with the newer techniques of displaying information to aircrews. At highly task-loaded moments, pilots are often so stressed that they channelize attention and ignore indications of trouble. Thus, human-factors problems cancel the technological advances being introduced into modern aircraft cockpits. To help solve those problems, the investigators attempted to do the following: appraise the reality and severity of shortcomings in display instrumentation and its use; and arrange for specific laboratory research by the Army and the Air Force, followed by tests and demonstrations. They presented their findings and recommendations to the Air Staff and the Air Force Scientific Advisory Board, as well as the Army Deputy Under Secretary for Operations Research and the Commander of the Army Aviation Center and his aeromedical staff at Fort Rucker. GRA

N92-32031# Ottawa Univ. (Ontario). School of Human Kinetics.
PRELIMINARY DEVELOPMENT OF A PROTOCOL FOR DETERMINING HEAT STRESS CAUSED BY CLOTHING Final Report

J. S. THODEN, M. JETTE, and J. QUENNEVILLE Jun. 1989 124 p

(Contract DREO-55SS.W7714-8-5725)

(DREO-PSD-EPS-05/89; CTN-92-60329) Avail: CASI HC A06/MF A02

A study was undertaken to develop an effective and efficient exercise protocol with which to evaluate the rates of change in body temperature under specific conditions of exercise while wearing different types of protective clothing. The specific objectives of the program were to determine if: (1) oesophageal, rectal and left middle finger-tip temperature followed the same response to serial exposures to steady state exercise and rest; (2) responses in oesophageal, rectal or finger-tip temperature during exercise were substantially affected by wearing clothing with different insulating properties; and (3) if repetitive cycles of steady-state exercise to produce the relatively unstressful change of rectal temperature of 38.5 C and 38.3 C would provide an effective protocol for the evaluation of change in rectal, oesophageal and finger-tip temperature in response to clothing with different insulating properties. It was concluded that different types of information can be derived from each thermistor location. Information from rectal and oesophageal thermometers is complementary but slightly out of phase and of different magnitude. The combination of thermistor locations and the exercise-rest cycle protocol is insufficiently sensitive to detect changes in body temperature caused by different types of insulation. CISTI

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SPACE BIOLOGY

Includes exobiology; planetary biology; and extraterrestrial life.

A92-51413* National Aeronautics and Space Administration, Washington, DC.

MOLECULAR REPLICATION

LESLIE E. ORGEL (Salk Institute for Biological Studies, San Diego, CA) Nature (ISSN 0028-0836), vol. 358, no. 6383, July 16, 1992, p. 203-209. Research supported by NASA. refs
Copyright

Recent experiments demonstrating nonenzymatic replication in molecular systems are reviewed. The difficulties facing nonenzymatic replication are discussed along with specificity, fidelity, and mutation in nonenzymatic replication. The prospects for research in this area are considered. C.D.

A92-51848* National Aeronautics and Space Administration, Washington, DC.

RECENT ADVANCES IN CHEMICAL EVOLUTION AND THE ORIGINS OF LIFE

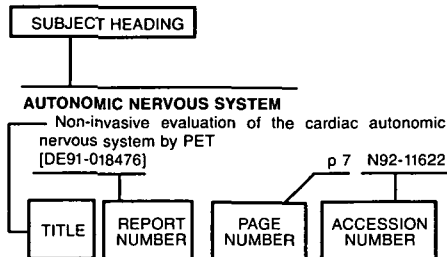
JOHN ORO (Houston, University, TX) and ANTONIO LAZCANO (Universidad Nacional Autonoma de Mexico, Coyoacan, Mexico) (IAF, International Astronautical Congress, 41st, Dresden, Germany, Oct. 8-12, 1990) Acta Astronautica (ISSN 0094-5765), vol. 26, no. 3-4, Mar.-Apr. 1992, p. 157, 158. refs
(Contract NGR-44-005-002)

(IAF PAPER 90-590) Copyright

Consideration is given to the ideas of Oparin and Haldane who independently suggested more than 60 years ago that the first forms of life were anaerobic, heterotrophic bacteria that emerged as the result of a long period of chemical abiotic synthesis of organic compounds. It is suggested that at least some requirements for life are met in the Galaxy due to the cosmic abundance of carbon, nitrogen, oxygen, and other biogenic elements; the existence of extraterrestrial organic compounds; and the processes of stellar and interstellar planetary formation.

O.G.

Typical Subject Index Listing



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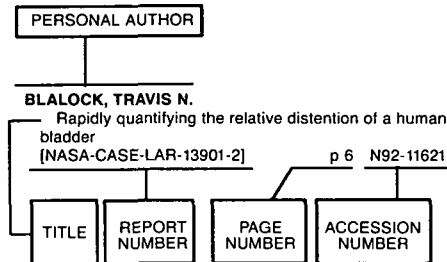
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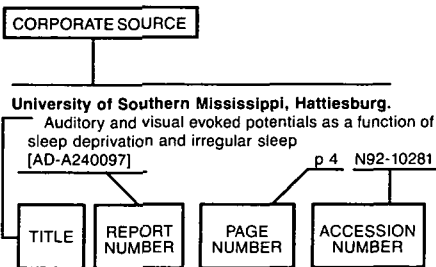
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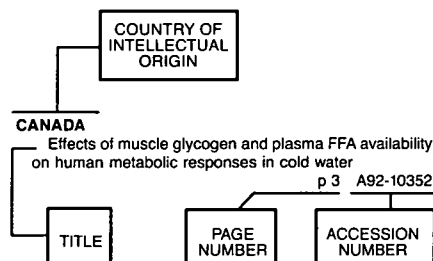
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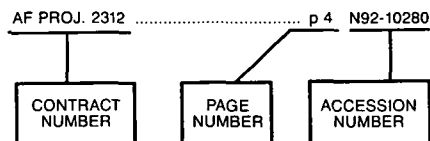
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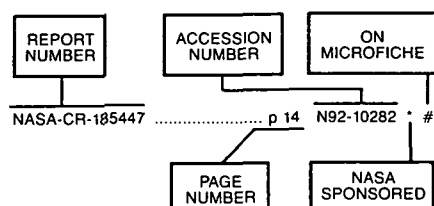
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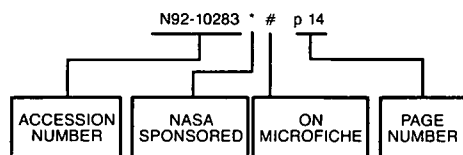
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NEW MEXICO STATE LIBRARY

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NEW YORK STATE LIBRARY
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Cultural Education Center
Albany, NY 12230
(518) 474-5563 FAX: (518) 474-5786

NORTH CAROLINA

UNIV. OF NORTH CAROLINA - CHAPEL HILL
CB#3912, Davis Library
BA/SS Dept.—Documents
Chapel Hill, NC 27599
(919) 962-1151 FAX: (919) 962-0484

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NORTH DAKOTA STATE UNIV. LIBRARY
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OKLAHOMA DEPT. OF LIBRARIES
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Oklahoma City, OK 73105-3298
(405) 521-2502, ext. 252, 253
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Stillwater, OK 74078
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Millar Library
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Portland, OR 97207
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Logan, UT 84322-3000
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